| (51)Int.Cl.⁷		識別記号	FI			テーマコード(参考)
B41M	3/14		B41M	3/14		2C005
B42D	15/10	501	B42D	15/10	501P	2H113
		531			531B	5B057
G06T	1/00	500	G06T	1/00	500B	5C076
H04N	1/387		H04N	1/387		

審査請求　有　請求項の数9　OL　（全 13 頁）

(54)【発明の名称】　真偽判別可能な印刷物及び判別方法、並びに該印刷物への情報を埋め込む方法

(57)【要約】

【課題】　印刷画線の持つ美術的な効果減じることとなく、証券用線画を構成する細画線に人間の視覚では認識できない多様な情報を埋め込み、印刷線画のフーリエ変換パターンにより真偽判別可能な印刷物を実現する。

【解決手段】　証券用線画1を構成する細画線2を、複数の分断線8から成るユニット5が連続的に配置されたユニット画線6で構成し、各ユニット5内の分断線8の配置の間隔を変えることにより、情報を埋め込んで成る印刷物4をフーリエ変換し、分断線8の配置の間隔の相関をそのフーリエ変換パターンのピーク強度として抽出して真偽判別可能とする。
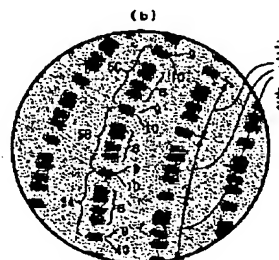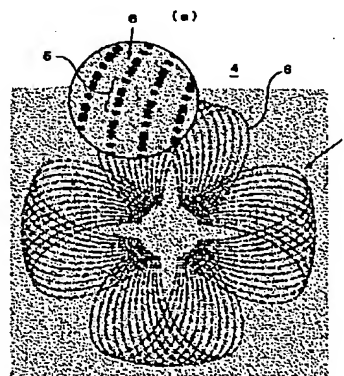
【特許請求の範囲】

【請求項1】 複数の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、

上記細画線は、複数のユニットが連続的に配置された可視的なユニット画線から構成され、

上記複数のユニットは、夫々上記細画線の長手方向に対して直交する方向に延び且つ細画線の長手方向に沿って並列された複数の不可視な分断線から成り、

上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定されており、

上記埋め込まれた情報は、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能であることを特徴とする真偽判別可能な印刷物。

【請求項2】 上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔に係る構成は、上記複数のユニットの全てについて同じであることを特徴とする請求項1記載の真偽判別可能な印刷物。

【請求項3】 複数の細画線から成る証券用線画を有する印刷物を出力可能なデジタル画像データを作成し、

上記デジタル画像データにおける上記複数の細画線を、複数のユニットが連続的に配置された可視的なユニット画線で構成されるように変換し所定の情報を埋め込む真偽判別可能な印刷物の情報埋め込み方法であって、

上記複数のユニットは、夫々上記細画線の長手方向に対して直交する方向に延び且つ細画線の長手方向に沿って並列された複数の不可視な分断線から形成し、

この際、上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定し、

上記埋め込まれた情報を、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能とすることを特徴とする真偽判別可能な印刷物の情報埋め込み方法。

【請求項4】 上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔に係る構成を、上記複数のユニットの全てについて同じに形成することを特徴とする請求項3記載の真偽判別可能な印刷物の情報埋め込み方法。

【請求項5】 複数の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、上記細画線は、複数のユニットが連続的に配置された可視的なユニット画線から構成され、上記複数のユニットは、夫々上記細画線の長手方向に対して直交する方向に延び且つ細画線の長手方向に沿って並列された複数の不可視な分断線から成り、上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め

込まれる情報に対応して設定されて成る真偽判別可能な印刷物の真偽判別方法であって、

上記印刷物のデジタル画像データをフーリエ変換してフーリエ変換パターンを作成し、該フーリエ変換パターンで上記埋め込まれた情報を識別することを特徴とする真偽判別可能な印刷物の真偽判別方法。

【請求項6】 上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔に係る構成は、上記複数のユニットの全てについて同じであることを特徴とする真偽判別可能な請求項5記載の印刷物の真偽判別方法。

【請求項7】 複数本の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、

上記細画線は、夫々上記細画線の長手方向に対して直交する方向に延び、且つ上記細画線の長手方向に沿って並列された複数の不可視な分断線から成る可視的な分断画線から構成されており、

上記複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔は、上記証券用線画に所定の情報が埋め込まれるように、夫々設定されており、

上記埋め込まれた情報は、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能であることを特徴とする真偽判別可能な印刷物。

【請求項8】 複数本の細画線から証券用線画を有する真偽判別可能な印刷物を出力可能なデジタル画像データを作成し、

上記細画線を、夫々上記細画線の長手方向に対して直交する方向に延び、且つ上記細画線の長手方向に沿って並列された複数の不可視な分断線から成る可視的な分断画線から構成されるように変換し、所定の情報を埋め込む真偽判別可能な印刷物の情報埋め込み方法であって、

上記複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔を、上記証券用線画に所定の情報が埋め込まれるように、夫々設定し、

上記埋め込まれた情報を、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能とすることを特徴とする真偽判別可能な印刷物の情報埋め込み方法。

【請求項9】 複数本の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、上記細画線は、夫々上記細画線の長手方向に対して直交する方向に延び、且つ上記細画線の長手方向に沿って並列された複数の不可視な分断線から成る可視的な分断画線から構成されており、上記複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔は、上記証券用線画に所定の情報が埋め込まれるように、夫々設定されて成る真偽判別可能な印刷物の真偽判別方法であって、

上記印刷物のデジタル画像データをフーリエ変換してフーリエ変換パターンを作成し、該フーリエ変換パターン

で上記埋め込まれた情報を識別することを特徴とする真偽判別可能な印刷物の真偽判別方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、真偽判別可能な銀行券、株券、債券等の有価証券、各種証明書及び重要書類等の印刷物に関する。

【0002】

【従来の技術】銀行券、株券、債券等の有価証券、各種証明書及び重要書類等の印刷物において偽造、変造防止策は重要な要素である。これら印刷物の偽造、変造防止策は主に幾何学模様を多用化した図柄をデザインに用いる方法と、印刷物に対し何等かの手段と作用を加えると目視では認識できなかった潜像を現出するような方法がある。

【0003】前者の代表的な例は、証券印刷物等のデザインに広く用いられている地紋、彩紋模様、レリーフ模様等の幾何学模様を用いたものであるが、前記幾何学模様を用いた偽造、変造防止策としては、基本的に一定の画線幅による曲画線の集合によって模様を構成しているものである。

【0004】これらの模様は印刷物のデザイン等の意匠性を加味し、且つ写真製版装置による抽出または複写機では再現されにくい色彩を用いたり、複雑な曲画線にして複写機及びスキャナの走査入出力に対し、モアレを発生させたりすることで偽造防止策としての役割を高めているが、最近では高機能化した写真製版装置または複写機の出現によって充分な偽造、変造防止効果をもたらしていないという欠点がある。

【0005】また前記の印刷物に対し何等かの手段と作用を加える後者の代表的な例のうち、最も多く用いられている偽造、変造防止策は、一般的にコピー防止画線と称する一連の技術で、印刷物中に施された潜像が目視では認識できなく、複写機によって複写することにより潜像が現出するもので、このような複写機による偽造防止に適する印刷物においては、すでに開示されている次の①～③の技術手段がある。

【0006】①基紙表面に、例えば85線30%の網点である微細構成素子よりなる文字を表示した複写による偽造防止に適する潜像を付与した印刷物（特開昭57－20395号公報）がある。

【0007】②用紙の表面に網点で潜像を印刷し、万線で潜像と同濃度の背景を同時印刷し、背景を含む潜像の上面に装飾模様をコピーで再現されない程度の薄色の透明性インキで重ね刷りすることにより、印刷物表面を体裁よく仕上げた複写防止に適する印刷物（特開昭60－79991号公報）がある。

【0008】③背景の万線と干渉した時にモアレ模様を形成する平行線よりなる波形パターンを備えたオーバープリント版を用いて、用紙表面に複写機で再生されない淡色の重ね刷りを施すことにより、印刷物の表面は肉眼を幻惑するモアレ模様が形成されるので潜像の存在は識別困難となり、複写機にかけると潜像と波形パターンは再生されずに背景のみが再生される複写防止用潜像カムフラージ法（特開昭60－87380号公報）がある。

【0009】しかし、前述①②③の方法はいずれも網点もしくは万線等の点及び線の粗密からなるスクリーンパターンでなければならないため、地紋、彩紋模様を多用している銀行券、株券、債券などの有価証券等の既存製品に用いるには適さないという欠点があった。

【0010】本願発明者らは前述①②③の方法が有する欠点を充分補える方法として、次の④、⑤の技術手段をすでに紹介している。

【0011】④曲画線の集合模様を、潜像を施さない部分を一本線、潜像を施した部分を二本線以上の画線で表現し、潜像を施した部分の二本線以上の画線は、二本線以上の画線の合計の画線幅が、潜像を施さない部分の一本線の画線の画線幅と等しく、且つ、潜像を施さない部分の一本線から分岐し、更に、潜像を施さない部分と潜像を施した部分の画線上の境界線が、曲画線の集合模様を構成する基本曲線と潜像の輪郭線の交点において基本曲線に接する直線に対し、略直角に交わる直線となることを特徴とする複写防止模様の作成方法及びその印刷物（特願平6－206140号）を出願した。

【0012】⑤曲画線の集合模様に、潜像を施さない部分を実線、潜像を施した部分を定周期断絶線で表現し、潜像を施した部分の定周期断絶線の合計上の実印刷される画線部と、画線部が断絶して欠落する非画線部の一周期において、画線部の面積に非画線部の面積を加算し、潜像を施した部分と潜像を施さない部分の曲線状方向の同一長さで同一画線面積率とする印刷物（特願平7－138879）を発明し出願した。

【0013】これら④⑤の模様を有する印刷物によって、複写防止を必要とする銀行券、株券、債券等の有価証券、各種証明書及び重要書類等の、地紋、彩紋模様、レリーフ模様等の曲画線の集合模様に複写機による偽造、変造防止効果を付与した複写防止模様の作成方法及び印刷物を提供することができた。

【0014】しかし、今日ではカラー複写機の高機能化及びDTP（デスクトップパブリッシング）技術の高度化によって、前述④⑤の方法のコピー防止策は十分な偽造防止策に成り得なくなって来ているのが現状である。

【0015】そこで、このような問題の解決法として、真偽判別において大量且つ高速処理できる機械読み取り検査方法が広く採用されている。今日の印刷物の機械読み取り検査方法は、磁性インキ、赤外線反射吸収インキ、蛍光インキ等の機能性インキや、印刷媒体を形成する繊維、材質、薬品類等による素材を検知するといったこれらの技術は、人間に感知できない特定の電磁波等に起因するものであり、印刷物を作製する上で材料適性に

依存するものが多く、生産コスト面において経済性の見合う製品にしか付与することができない。

【0016】また、印刷物の生産コストを特に考慮しない方法としては、可視できる一般印刷用のインキのような印刷材料が適用可能な印刷物上の模様に対する光学読み取り方法がある。比較的容易な光学読み取り方法としては、OCR、OMR、バーコード、二次元コード等が公知であるが、これらの光学読み取り方法を既存製品に用いる場合は、デザイン、仕様の変更が要求される。

【0017】また、これらの光学読み取り方法は広く市中に出回っている方法でもあり、符号が印刷画線として可視できるため、解読、改竄の危険性も予想され、偽造、変造防止方法としては不十分である。

【0018】更に、同じく光学読み取り方法でデザイン等の意匠性を変えずに読み取り用情報を付与する方法として、一般に電子すかしと呼ばれる一連の技術がある。電子すかしは、コンシールドイメージ、デジタルすかしとも呼ばれ、主な用途として、高機能化したコピー技術やDTP技術におけるドキュメントファイルもしくはその印刷物に著作権情報を埋め込む技術である。印刷物における公知の代表的な技術としては、周波数利用型と呼ばれる方法である。

【0019】電子すかしは複製物においてもその周波数特性の劣化が少ないと言われ、最近では著作権保護の目的でインターネット上に配信されるデジタルイメージに施されることが多い。また、印刷物においてもその効果を奏することから、ポスターなどに利用されることも多くなって来た。

【0020】電子すかしが最も効果を発揮できるのは連続階調（写真階調）模様である。連続階調（写真階調）模様は多値画像データであるから、十分な冗長度が存在するので周波数利用型に限らず画素置換型、画素空間利用型、量子化誤差拡散型等の多くの方法が提案され、文献、特許出願も数多く、今日注目を集めている技術の一つである。

【0021】しかしながら、有価証券に用いられる地紋、彩紋模様、レリーフ模様等の曲画線の集合模様は基本的に2値画像であるから冗長度が少ないので、電子すかしの埋め込みは困難とされ、結果として読み取り用信号が弱いために読み取り精度が低いのが課題となっている。

【0022】従って、印刷物の材料適性に依存しない偽造、変造防止方法で、例えば銀行券、株券、債券等の有価証券、各種証明書及び重要書類等に適する偽造防止適性を有する模様を機械読み取りによって真偽判別できる有効な技術の開発が望まれている。

【0023】
【発明が解決しようとする課題】本発明は上述の点に鑑みなされたもので、証券用線画から構成されている証券類等の芸術性を有する印刷物において、人間が視覚で認

識できないレベルで証券用線画に変調を与えることにより、その美術的な効果を損なうことなく情報を埋め込むことを目的としている。

【0024】ところで、本発明者等はすでに、証券用線画の細画線を長手方向に所定の間隔で並列された複数の分断線から成る分断画線部で構成する真偽判別可能な印刷物及び判別方法、情報埋め込み方法に関する発明を特願2002-1519号としてすでに提案している。この先行する出願に係る発明は、人間の目には分断画線部と通常の細画線が同等に見えるように、その分断線の幅と長さを決め、これをフーリエ変換し、そのフーリエ変換パターンにおいて固有の周波数を認識し、真偽判別等に応用する技術である。

【0025】しかしながら、この先行する発明では、証券用線画の細画線を構成する分断画線部の複数の分断線は、単に一定間隔で長手方向に並列しているもので、付与できる情報は、固有の不可視な周波数の種類に限定され、多くのバリエーションを与えることができない。そこで本発明では、この分断線の配置の間隔を工夫して細画線を形成し、その美術的な効果を損なうことなく、よりきめ細かく又多様な情報を埋め込んで偽造防止効果を高めることを可能とすることを課題とするものである

【0026】
【課題を解決するための手段】本発明は上記課題を解決するために、複数の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、上記細画線は、複数のユニットが連続的に配置された可視的なユニット画線から構成され、上記複数のユニットは、夫々上記細画線の長手方向に対して直交する方向に延び且つ細画線の長手方向に沿って並列された複数の不可視な分断線から成り、上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定されており、上記埋め込まれた情報は、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能であることを特徴とする真偽判別可能な印刷物を提供する。

【0027】上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔に係る構成は、上記複数のユニットの全てについて同じである。

【0028】本発明は上記課題を解決するために、複数の細画線から成る証券用線画を有する印刷物を出力可能なデジタル画像データを作成し、上記デジタル画像データにおける上記複数の細画線を、複数のユニットが連続的に配置された可視的なユニット画線で構成されるように変換し所定の情報を埋め込む真偽判別可能な印刷物の情報埋め込み方法であって、上記複数のユニットは、夫々上記細画線の長手方向に対して直交する方向に延び且つ細画線の長手方向に沿って並列された複数の不可視な分断線から形成し、この際、上記ユニット内において上

記複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定し、上記埋め込まれた情報を、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能とすることを特徴とする真偽判別可能な印刷物の情報埋め込み方法を提供する。

【0029】上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔に係る構成を、上記複数のユニットの全てについて同じに形成することを特徴とする。

【0030】本発明は上記課題を解決するために、複数の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、上記細画線は、複数のユニットが連続的に配置された可視的なユニット画線から構成され、上記複数のユニットは、夫々上記細画線の長手方向に対して直交する方向に延び且つ細画線の長手方向に沿って並列された複数の不可視な分断線から成り、上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定されて成る真偽判別可能な印刷物の真偽判別方法であって、上記印刷物のデジタル画像データをフーリエ変換してフーリエ変換パターンを作成し、該フーリエ変換パターンで上記埋め込まれた情報を識別することを特徴とする真偽判別可能な印刷物の真偽判別方法を提供する。

【0031】上記ユニット内において上記複数の分断線のうち互いに隣接する分断線がなす複数の間隔に係る構成は、上記複数のユニットの全てについて同じであることを特徴とする。

【0032】本発明は上記課題を解決するために、複数本の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、上記細画線は、夫々上記細画線の長手方向に対して直交する方向に延び、且つ上記細画線の長手方向に沿って並列された複数の不可視な分断線から成る可視的な分断画線から構成されており、上記複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔は、上記証券用線画に所定の情報が埋め込まれるように、夫々設定されており、上記埋め込まれた情報は、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能であることを特徴とする真偽判別可能な印刷物を提供する。

【0033】本発明は上記課題を解決するために、複数本の細画線から証券用線画を有する真偽判別可能な印刷物を出力可能なデジタル画像データを作成し、上記細画線を、夫々上記細画線の長手方向に対して直交する方向に延び、且つ上記細画線の長手方向に沿って並列された複数の不可視な分断線から成る可視的な分断画線から構成されるように変換し、所定の情報を埋め込む真偽判別可能な印刷物の情報埋め込み方法であって、上記複数の

分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔を、上記証券用線画に所定の情報が埋め込まれるように、夫々設定し、上記埋め込まれた情報を、上記印刷物のデジタル画像データがフーリエ変換されて得られるフーリエ変換パターンによって識別可能とすることを特徴とする真偽判別可能な印刷物の情報埋め込み方法を提供する。

【0034】本発明は上記課題を解決するために、複数本の細画線から成る証券用線画を有する真偽判別可能な印刷物であって、上記細画線は、夫々上記細画線の長手方向に対して直交する方向に延び、且つ上記細画線の長手方向に沿って並列された複数の不可視な分断線から成る可視的な分断画線から構成されており、上記複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔は、上記証券用線画に所定の情報が埋め込まれるように、夫々設定されて成る真偽判別可能な印刷物の真偽判別方法であって、上記印刷物のデジタル画像データをフーリエ変換してフーリエ変換パターンを作成し、該フーリエ変換パターンで上記埋め込まれた情報を識別することを特徴とする真偽判別可能な印刷物の真偽判別方法を提供する。

【0035】
【発明の実施の形態】本発明に係る印刷物及び判別方法、並びに該印刷物への情報の埋め込み方法の実施の形態を実施例に基づいて図面を参照して以下詳細に説明する。証券類、紙幣等に使用されている証券用線画は、万線状の直線（直万線）や曲線を含む画線が複数集合して幾何学的なデザインで構成されている。このような証券用線画を構成する要素となる画線を本発明では「細画線」という。証券用線画では、複数の細画線の間隔等において非常に高い規則性が存在する。

【0036】本発明は、この規則性に着目し、証券用線画の複数の細画線の間隔及び位置の相関を評価して真偽判別の手段として活用するものである。

【0037】さらに、本発明では、この規則性を有する証券用線画を構成する複数本の細画線を、スキャナ、複写機等のデジタル機器では識別可能であるが、人間にとって視覚で認識困難な微細な部分（後述する「分断線」）を並べて構成するように変調を与えて情報を埋め込み、このようにして得られた印刷物をデジタル画像に変換して、デジタル機器（具体的には、コンピュータ）上で、証券用線画の間隔及び位置、上記微細な部分の配置等による相関を分析し、印刷物に埋め込まれた情報を識別することにより、真偽判別を可能とするものである。

【0038】人間の視覚で認識できないレベルで証券用線画に変調を与える構成として、本発明は、証券用線画を構成する細画線の一部又は全部を、複数のユニットから成るユニット画線で形成する構成にしている。このようなユニット画線が複数集まりユニット画線群となり、

証券用線画を形成する。

【００３９】複数のユニットの長さ（以下、「ユニット長さ」という。）は予め決めた所定の長さとし、各ユニットを、複数の不可視的な分断線から構成する。この複数の分断線は、夫々細画線の中心線と直交する方向に延び、且つ細画線方向に並列して配置される構成とし、このユニット内の複数の分断線を、細画線方向への互いの間隔を適宜設定して配置すること（複数の分断線の細画線方向への配置の間隔を決めること。）で情報を埋め込む構成としている。即ち、ユニット内において複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定される。

【００４０】要するに、本発明は、原図である証券用線画を構成する細画線をユニット画線で形成し、このユニット画線は、人間の視覚では原図の細画線と濃度が同等で、原図と同じように証券用線画が見えるような構成とし、ユニットを構成する分断線は不可視となるように分断線の長さ（細画線の中心線に直交する方向への分断線の長さ。）及び幅（細画線の延びる方向への分断線の幅。）、さらに相互の間隔が決められる。そして、証券用線画の規則性（証券用線画の複数本の細画線の間隔及び方向。）に基づき、又、ユニット内の分断線の互いの間隔を適宜設定して配置することにより、所定の情報が埋め込まれるような構成としている。

【００４１】このようにして埋め込まれた情報を識別し、印刷物の真偽判別をするには、複数のユニット画線から成るユニット画線群で構成される証券用線画についてフーリエ変換を行い、このフーリエ変換パターンから、証券用線画上のユニット長さ及びユニット内における分断線の配置に関する情報を抽出して、埋め込んだ情報を抽出し識別に供するものである。

【００４２】さらに、本発明は、印刷物の証券用線画を構成する細画線は、上記のようにユニットを単位とするものではなく、複数の分断線が配置されて成る分断画線から構成し、複数の分断画線が集まって分断画線群を構成し、この分断画線群により、印刷物の証券用線画を表示する印刷物及び判別方法、並びに該印刷物への情報の埋め込み方法も含むものである。

【００４３】（実施例１）本発明に係る印刷物及び判別方法、並びに該印刷物への情報の埋め込み方法の実施例１を説明する。図１は、本発明に係る印刷物の原図となる証券用線画の一例である。この証券用線画１は、印刷された細画線２から成る彩紋エレメント３を有しているが、この細画線２乃至彩紋エレメント３は人間の視覚で認識できるものである。

【００４４】この証券用線画１の彩紋エレメント３に基づいて、図２（ａ）に示す本発明の実施例１の印刷物４を作成する。印刷物４は、彩紋エレメント３を構成する複数の細画線２を、夫々複数の同じ構成のユニット５から成るユニット画線６で形成し、ユニット画線６で彩紋エレメント３が描画されて成る画像である。要するに、複数のユニット画線６が集合したユニット画線群７で彩紋エレメント３を表示するものである。このユニット画線６は、画線どうしの間隔及び方向は原図の細画線２と全く同じである。

【００４５】図２（ａ）の円内に、ユニット画線６の一部拡大図が示されている。この拡大図中の１本のユニット画線６を、さらに拡大して図２（ｂ）で示す。ユニット画線６を構成する各ユニット５Ａ、５Ｂ、５Ｃは、互いに同じ構成であり、予め決められた所定の長さ（「ユニット長さ」という。）を有し、複数の分断線から構成される。具体的には、ユニット５Ａ、５Ｂ、５Ｃは、夫々情報を埋め込む複数の情報用分断線８と、情報用分断線８の両側の始端分断線９及び終端分断線１０とから成る。

【００４６】ところで、ユニット画線６は、本実施例１では複数の同じ構成のユニット５が連続的に繰り返し配置されて構成されるが、互いに隣接するユニット５Ａ、５Ｂは、始端分断線９、終端分断線１０を共有している。これを図２（ｂ）を例として説明すると、ユニット５Ａの終端分断線１０は、ユニット５Ｂの始端分断線９として両ユニット５Ａ、５Ｂに共有され、分断線５Ｂの終端分断線１０は、ユニット５Ｃの始端分断線９として両ユニット５Ｂ、５Ｃに共有されている。

【００４７】ユニット５は、所定の情報を埋め込む構成とされているが、図３は、所定の情報を埋め込んだユニット５の具体的な構成を示す図である。このユニット５は、始端分断線９と終端分断線１０の間に４本の情報用分断線8_1〜8_4が配置されて構成されている。所定の情報は４本の情報用分断線8_1〜8_4の互いの間隔を適宜決めることで埋め込まれる。

【００４８】予め埋め込む情報を構成する情報要素（例．数字等の記号）に対応して間隔を予め決めておく。本実施例１では、情報要素を十進数字とし、対応する間隔の一例を次の表１において示す。この表１中、＊、＃は、夫々識別子を表し、その必要性については後述するが、識別子＊は、始端分断線９と情報用分断線8_1との間隔に対応するものであり、識別子＃は、終端分断線１０と情報用分断線8_4との間隔に対応するものである。

【００４９】

【表１】

情報／識別子	0	1	2	3	4	5	6	7	8	9	＊	＃
間隔（μm）	50	60	70	80	90	100	110	120	130	140	150	160

【００５０】この表１に基づいて、ユニット５について、「２６４」という十進数字の組み合わせから成る情

報を埋め込むためには、識別子＊と情報用分断線8₁との間隔を150μm、情報用分断線8₁と情報用分断線8₂の間隔を70μm、情報用分断線8₂と情報用分断線8₃の間隔を110μm、情報用分断線8₃と情報用分断線8₄の間隔を90μmに、情報用分断線8₄と識別子＃の間隔を160μmに、夫々配置すればよい。

【0051】ユニット長さは、これらの間隔を合計した値である580μmとなる。ユニット画線6は、このような構成の複数のユニット5が原図の細画線2（図1参照）に沿って連続的に繰り返されて配置されて構成される。

【0052】ここで、ユニット5内に、識別子＊及び識別子＃を配置する必要性について説明する。本発明に係る印刷物は、後述するがフーリエ変換画像としてパターンマッチング等の手段でその識別を行うものであるが、情報「264」をフーリエ変換画像で確認すると対称的に画像が現れるために、情報「462」をフーリエ変換画像したものと、同じ位置と強度を示すこととなり、判別が不可能となる。

【0053】そこで、この判別を可能とするために、識別子＊を間隔150μmに対応させ、識別子＃を間隔160μmに対応させ、情報要素とともに表1に登録し、＊は情報の開始を表す識別子、＃は情報の終了を表す識別子として夫々使用するのである。ここで、情報の開始を表す識別子＊のみを使用し、情報の終了を表す識別子＃を使用しない場合、すなわち、「＊264」と「＊462」を比較すると「＊264」は「264＊」と同等に置き換えることが可能であり、さらに前述のように反対方向から読むと「＊462」となってしまい、「＊264」と「＊462」は同じフーリエ変換パターンとなってしまうことが分かる。そこで、情報の終了を表す識別子＃を用いれば、「＊264＃」と「＊462＃」は同じパターンとならないことから、両者の識別が可能となる。

【0054】図1に示す原図の証券用線画1では、細画線2の幅（線の太さ）は55μmとなっている。図2（a）に示すように細画線2をユニット画線6で形成した印刷物として作成された場合、ユニット5の分断線8～10は、夫々人間の目には不可視であるが、ユニット画線6は、原図である証券用線画1の細画線2と同様に人間の目で見えるようにするには、分断線8～10の間隔及び分断線の寸法（幅Wと長さL）を調節する必要がある。具体的には、分断線8～10の間隔に応じて、その寸法（幅Wと長さL）を調節する。

【0055】本実施例1では、情報「＊264＃」に対応する分断線間の間隔を平均化すると、（150μm＋70μm＋110μm＋90μm＋160μm）÷5＝116μmとなる。この分断線間の平均の間隔が116μmという数値に対応して、情報用分断線、始端分断線及び終端分断線の全ての分断線の夫々の幅Wを30μm

とし、長さLを293μmと設定することができる。ユニット5の分断線をこのような寸法とすることにより、人間に対してユニット画線6は可視でも、分断線8～10は不可視状態となる。

【0056】ところで、本出願人は、細画線2を本発明のようなユニット画線6で形成する技術ではないが、機械読取りで真偽判別を行う有価証券等において、細画線の一部を分断線で構成し、この分断線をより完全に不可視化する技術について、すでに特許出願を行っている（特開2000-118121号公報参照。）。この不可視化する技術を本発明に適用すると、本発明における分断線のより完全なる不可視化が可能となる。

【0057】この分断線を不可視化する技術の概要は次の通りである。分断線の長さ決める際には、その分断線の前後の隣接する分断線との間隔の平均値を算出して、この平均値に対応する幅及び長さを決定する。この技術を本発明に適用した構成について、図3に示すユニット5で具体的に説明する。

【0058】例えば、情報用分断線8₁の幅及び長さを決める場合は、次のようにする。始端分断線9と情報用分断線8₁との間の間隔（識別子＊に対応する間隔）は150μmであり、情報用分断線8₁と情報用分断線8₂の間隔（情報要素"2"に対応する間隔）は70μmである。この情報用分断線8₁の両側の間隔150μmと70μmとの平均値110μmを算出し、情報用分断線8₁の幅は分断線間隔110μmで一定となる場合の幅と長さを与えることとする。

【0059】以上のように、図1に示す原図の証券用線画1の細画線2をユニット画線6で形成し、ユニット画線6の集合であるユニット画線群7で図2（a）に示す証券用線画を表示するには、まず証券用線画1をスキャナ等のデジタル機器で読み取ってビットマップデータ等のデジタル画像データとし、これを作画ソフト（例えば、アドビ社から市販されているイラストレータとして一般的なバルコシステム等）で細画線2を加工してユニット画線6に置き換える。

【0060】或いは、コンピュータで、作画ソフトを利用して直接、ユニット画線群7で表示する図2（a）に示す証券用線画のデジタル画像を作成してもよい。いずれにしろ、このデジタル画像は、印刷出力すれば図2（a）に示す印刷物が作成されるものであればよい。本発明ではこのような、印刷物の作画の仕方自体を発明の要旨とするものではないから、この点の説明は省略する。

【0061】以上のような複数のユニット5から成るユニット画線6は、複数本集まってユニット画線群7となり証券用線画を表示する。これらのユニット画線群7は、複数のユニット画線7の相互の間隔に基づく異なる空間周波数を有し、しかもユニット5に情報「＊264＃」が埋め込まれており、これを印刷出力すれば、見た

目では図1に示す証券用線画1とは変わらない本発明に係る真偽判別可能な印刷物4が作成される。

【0062】同様に、例えば、図1に示す同じ証券用線画1に、別の情報「＊831＃」を埋め込んだユニット12を有する印刷物11を作成するには、表1に基づいて、図4に示すように、情報「＊831＃」に対応するように、始端分断線9、情報分断8線及び終端分断線10の夫々の間隔を決めて、ユニット12を作成する。このユニット12のユニット長さは、印刷物11と同様に580μmである。

【0063】そしてこのユニット12を複数、細画線の方向に連続して繰り返して構成されるユニット画線13で、原図1の細画線2を形成し、図5に示すような、ユニット画線13が集まったユニット画線群14で証券用線画を表示する印刷物11を作成することができる。

【0064】次に以上のような情報の埋め込み方法で、情報が埋め込まれた印刷物の当該情報を識別する手段、方法について説明する。上記印刷物4、11をスキャナ等の読取装置で読み込み、読取結果をビットマップデータ（本発明の「デジタル画像データ」の一例である。）として保有する。そして、このビットマップデータをフーリエ変換する。

【0065】本実施例の印刷物4のフーリエ変換画像15を図6に示し、印刷物11のフーリエ変換画像16を図7に夫々示す。これらのフーリエ変換画像15、16を例に、埋め込まれた情報「＊264＃」、情報「＊831＃」の夫々について、増補に基づく相関が、フーリエ変換パターンにどのように現れるか説明する。

【0066】印刷物4、11のフーリエ変換画像15、16において、フーリエ変換パターンにおけるピーク位置は同じ周波数に観測されている。すなわち、印刷物4と印刷物11におけるユニット長さはどちらも580μmであり、このユニット長さに対応した周波数の位置、及びこの周波数の整数倍の位置にピークが観測されている。この点では、埋め込まれた情報の識別はつかない。

【0067】ところが、印刷物4と印刷物11のフーリエ変換パターンにおけるピークの強度は両者で異なり、

特に4次のピーク（中心から4つ目の輪）において両者の違いは顕著に現れている。印刷物1のユニット5と印刷物4のユニット12とは、夫々異なる情報（「＊264＃」、「＊831＃」）を埋め込むために情報用分断線の配置の間隔が異なるが、これに起因して4次のピークの強度が異なる。

【0068】すなわち、同じユニット長さであれば、フーリエ変換パターンは同じ周波数位置にピークが観測されるが、ユニット内の情報用分断線の配置の間隔が異なれば、ピーク強度が異なる。したがって、このフーリエ変換パターンを基に、印刷物へ埋め込んだ情報に係る情報用分断線のユニット内での配置の間隔を認識することができる。この情報用分断線の配置の間隔が埋め込んだ情報に相当するようにしておけば、印刷画線への所定の情報の埋め込み及びその読取が実現する。

【0069】ところで、フーリエ変換パターンから本発明に係る印刷物の埋め込み情報を識別する具体的な手段は、いくつかあるが、ここで三つの手段を挙げる。

（1）コンピュータ等の読取画像処理装置において、予め所定の埋め込み情報に対応するフーリエ変換パターンを記憶させておき、印刷物から読み取ったビットマップデータのフーリエ変換パターンを、この予め記憶してあるフーリエ変換パターンと比較して識別を行う（パターンマッチング）。

【0070】（2）予め所定の埋め込み情報に対応するフーリエ変換データのk次のピークの濃度分布曲線（フーリエ変換パターンにおけるピークのうち、内側からk番目のピークとなる濃度分布曲線を言う。）を予め用意し、これと、印刷物から読み取ったビットマップデータのフーリエ変換データのk次のピークの濃度分布とを比較する。

【0071】（3）印刷物から読み取ったビットマップデータのフーリエ変換パターンのk次のピーク位置における強度I（k）を次の数1で計算する。

【0072】

【数1】

$$I(k) = N \left\{ \sum_{i,j=1}^{n} \cos 2\pi k x_{ij} \right\}^2 \quad \cdots (1)$$

【0073】ここで、Nは画線全体にあるユニット5の数、nはユニット5の中の分断線の本数、x_{ij}は次の数2で与えられるユニット5中のi番目の分断線とj番目の分断線の間隔をユニット長さで規格化した数値を表

す。

【0074】

【数2】

$$x_{ij} = (d_j - d_i) \left/ \sum_{s=1}^{n} d_s \right. \quad \cdots (2)$$

【0075】これらの式（1）、（2）によって、フーリエ変換パターンのk次のピーク位置における強度I（k）の値を認識すれば、連立方程式を解くことにより

容易にユニット中の分断線の配置を求めることが可能となり、これにより埋め込み情報を識別することができる。

【0076】一例として、情報「＊264＃」を埋め込んだユニット5を有する印刷物1の識別を説明する。この印刷物1のデジタル画像を読取り、フーリエ変換を行い、フーリエ変換パターンを得たとする。読取装置ではそのFFTの1次のピーク位置から、ユニット長さは580μmであることが直ちに分かる。

【0077】そして、1次、2次、3次、…、n次のピークにおけるフーリエ変換パターンの相対強度をそれぞれ読み取り、これを上記数1数2にあてはめ、連立方程式を最小二乗法により解くことにより、ユニット5中の除法分断線の配置、すなわち、分断線の間隔の並びを解くことが可能である。

【0078】この連立方程式から、始端分断線9、情報用分断線8$_{1 \sim 4}$、及び終端分断線10が互いに隣接する間隔が、150μm、70μm、110μm、90μm、160μmと求まり、表1に基づき十進数字を識別することにより、埋め込んだ情報は「＊264＃」であることが識別できる。なお、情報「＊831」を埋め込んだ印刷物2についても同様に識別可能である。

【0079】以上のように、ユニットの中で同じ数字等の記号が繰り返されるような例でも明確なフーリエ変換パターンのピーク強度が得られることから分断線にバリエーションを持たせ、規則的に配置することにより情報の埋め込み、読み取りが可能である。この実施例1では3桁の十進数字から成る情報を埋め込んだが、本発明によれば、何桁の数字でも分断線を用いて数字等の記号を表現可能であり、その結果を数字等の情報に対応した特徴的なピーク位置の周波数と強度を有するフーリエ変換パターンから認識することができる。

【0080】（実施例1の変形例）ここで、本発明の実施例1の変形例に係る印刷物について以下説明する。この変形例は、図1に示す原図の証券用線画1を構成する細画線2を複数のユニットから成るユニット画線で形成し、ユニット画線の集まりであるユニット画線群で彩紋エレメント3の証券用線画を表示するものである。この印刷物のユニット画線は、画線どうしの間隔等は原図の証券用線画1の細画線の場合と全く同じである。

【0081】ユニット画線は、複数のユニットが繰り返し連続的に配置されて構成され、複数のユニットは、互いに同じユニット長さを有する。ユニットは、原図の細画線2の中心線と直交する方向に延びる複数本の分断線を細画線方向に並列して構成され、これにより情報を埋め込む構成としている。

【0082】ユニットには複数の分断線が配置されているが、この分断線の長さ及び幅、さらに相互の間隔は、分断線自体では不可視であるが、複数のユニットから成るユニット画線は、視覚的には原図の細画線2と濃度が同等で、原図の証券用線画1と同じように彩紋エレメント3が見えるように決められる。

【0083】ところで、ユニットの複数の分断線の配置の間隔（ユニット内において複数の分断線のうち互いに隣接する分断線がなす複数の間隔）を決めて所定の情報を埋め込むのであるが、実施例1では、ユニット画線を構成する複数のユニットにおける夫々のユニット内での複数の分断線の配置は、各ユニット同じであり、要するに分断線の配置が同じユニットが複数繰り返し連続的に配置されてユニット画線を構成している。

【0084】しかしながら、この変形例では、ユニット画線を構成する複数のユニットにおける夫々のユニット内での複数の分断線の配置の間隔は、各ユニットについて必ずしも同じでなくてもよい。要するに、この変形例では、分断線の配置が必ずしも同じではないユニットが複数繰り返し連続的に配置されてユニット画線を構成している。

【0085】この変形例に係る印刷物をスキャナで読取り、デジタル画像としてこれをフーリエ変換した画像が所定のフーリエ変換パターンとなるように、複数のユニット内で夫々独自に分断線の配置が決められるものである。要するに、フーリエ変換パターンが所定のパターンとなるように、複数のユニット内で夫々独自の分断線の配置をすることで情報を埋め込む構成としている。

【0086】このように変形例の印刷物では、ユニット画線を構成する複数のユニット夫々について、複数の分断線の配置は独自に決められ、夫々独自の分断線の配置のなされたユニットが複数連続的に配置されユニット画線が構成され、ユニット画線の集まりであるユニット画線群で証券用線画が表示されるもので、印刷物のフーリエ変換画像が所定のフーリエ変換パターンにマッチしているか否かでその真偽判別がなされる。

【0087】ところで、この変形例についてもフーリエ変換パターンから情報を識別する手段は、実施例1と同じで次の通りである。①予め記憶した所定のフーリエ変換パターンと印刷物のフーリエ変換画像について、マッチングを行う。②予め用意した所定フーリエ変換データのk次のピークの濃度分布曲線と印刷物のフーリエ変換データのk次のピークの濃度分布曲線を比較する。③印刷物のフーリエ変換データのk次のピーク位置における強度からユニットの配置を算出して識別する。

【0088】（実施例2）上記実施例1では、細画線を、分断線を有するユニットを単位として、複数のユニットを長手方向に連続して配置して成るユニット画線から構成するようにしたものである。しかしながら、細画線をユニットを単位としない構成としてもよい。この観点から、本発明者等は、本発明の実施例2を想到した。

【0089】即ち、実施例2に係る印刷物の証券用線画を構成する細画線は、実施例1のようにユニットを単位とするものではなく、細画線の長手方向に複数の分断線が配置されて成る分断画線から構成される。そして、分断画線が集まって分断画線群を構成し、この分断画線群により、印刷物の証券用線画が表示される。

【００９０】このように、証券用線画の構成要素の最小単位となる複数の分断線は、夫々細画線の長手方向に対して直交する方向に延び、且つ細画線の長手方向に沿って並列されている。そして、分断線の夫々の長さ及び幅、さらに相互の間隔は、分断線自体では不可視であるが、分断画線は、視覚的には原図の細画線と濃度が同等で、原図の証券用線画１と同じで彩紋エレメント３が見えるように、決められる。

【００９１】この複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔（相互の間隔）は、証券用線画に所定の情報が埋め込まれるように、夫々設定された構成を特徴とする。この埋め込まれた情報は、この実施例２に係る印刷物をスキャナで読取って得られたデジタル画像データをフーリエ変換して得られるフーリエ変換パターンによって識別可能である。要するに、分断線がなす複数の間隔は、埋め込まれる情報が印刷物のデジタル画像データのフーリエ変換パターンによって識別可能なように設定される。

【００９２】ここで重要なことは、この実施例２は、情報を埋め込むための複数の分断線のうち細画線の方向で互いに隣接する分断線がなす複数の間隔は、全て同一のものは含まれない。即ち、複数の分断線のなす間隔（分断線が繰り返されるピッチ）は均一である構成は含まず、埋め込まれる情報が印刷物のデジタル画像データのフーリエ変換パターンによって識別可能なように設定されていることである。ここで、複数の分断線のなす間隔を、例えば５０μmから１５０μmの間から乱数を用いて無作為に選び、分断線を配列した場合、分断線の数が十分大きければ、何度、分断線を発生させても、同じフーリエ変換パターンが得られる。これに対して、分断線の配置に人為的な作為を与えれば、そのフーリエ変換パターンは前記パターンと異なるものとなる。もっと具体的な例を挙げると、５０μmから１５０μmまで１０μm間隔で分断線の種類を設定しておき、この中から乱数を用いて分断線を配置する上で、人為的に８０μmのみ他の間隔の分断線の選択確率の２倍となるように設定しておく。このように操作して配列した分断線に対するフーリエ変換パターンは完全に無作為に間隔を選択、配列した分断線にした場合と異なるフーリエ変換パターンを生じることとなる。この特異的なフーリエ変換パターンから埋め込んだ情報を抽出することができる。

【００９３】要するに、実施例２に係る印刷物は、フーリエ変換パターンが所定のパターンとなるように、複数のユニット内で分断線を夫々全く独自に配置することで情報を埋め込む構成としている。

【００９４】この実施例２に係る印刷物を識別する手段は、具体的には、実施例２に係る印刷物をスキャナで読取って得られたデジタル画像データをフーリエ変換して得られるフーリエ変換パターンと、予め記憶した所定のフーリエ変換パターンとが、比較器でマッチングし、マッチングしているか否かで真偽判別が行われる構成である。

【００９５】なお、この実施例２においても、夫々の分断線の幅、長さ、互いの間隔を設計する際に、上記先願（特開２０００－１１８１２１号公報参照。）の分断線をより完全に不可視化を行う技術を適用することにより、分断線のより完全なる不可視化が可能となる。

【００９６】以上、本発明の実施の形態を実施例に基づいて説明したが、本発明はこのような実施例に限定されるものではなく、特許請求の範囲に記載された技術的事項の範囲内でいろいろな実施例があることは言うまでもない。

【００９７】

【発明の効果】以上の構成から成る本発明に係る真偽判別印刷物では、その証券用線画は人間の視覚で認識できるが、証券用線画を複数の分断線を有するユニットから成るユニット画線で構成することで、人間には不可視の情報を埋め込むことができ、しかもこの埋め込み情報は、証券用線画をデジタル画像として読み取りフーリエ変換を行い、マッチング等の処理をすることで識別可能であるから、印刷画線の持つ美術的な効果減じることなく、偽造防止効果を高めることができる。

【００９８】特に、本発明では、印刷物の原図の細画線を、複数の分断線を有するユニットから成るユニット画線で形成し、ユニット内において複数の分断線のうち互いに隣接する分断線がなす複数の間隔は、夫々埋め込まれる情報に対応して設定されるようにすることにより、情報を埋め込むことができ、しかもこの印刷物のデジタル画像のフーリエ変換パターンで簡単に情報を識別可能であるから、偽造防止効果を高めることができるとともに、低コストで、取り扱いが便利であり、銀行券、証券類、各種証明書及び重要書類等の多方面の分野で不可視な情報を埋め込む手段としてきわめて有用である。

【００９９】そして、本発明に用いられる画線では、単色印刷においてもその情報を人間の視覚で認識することは不可能であることから、印刷画線の持つ美術的な効果減じることもない。

【０１００】さらに、本発明では、細画線をユニット単位ではなく複数の不可視な分断線から成る可視な分断画線で形成可能とし、複数の分断線のなす間隔（分断線が繰り返されるピッチ）は、均一である構成は含まず、埋め込まれる情報が印刷物のデジタル画像データのフーリエ変換パターンによって識別可能なように設定することにより、より自由度をもって偽造防止効果の高い真偽判別可能な印刷物を実現することができる。

【図面の簡単な説明】

【図１】本発明の印刷物の原図となる証券用線画１である彩紋エレメント３を示す図である。

【図２】実施例１の印刷物の画像部の図形を説明する図である。

【図3】実施例1の印刷物の要部を説明する図である。
【図4】実施例1の別の印刷物の要部を説明する図である。
【図5】実施例1の別の印刷物の画像部の図形を説明する図である。
【図6】実施例1の印刷物のフーリエ変換パターンを示す図である。
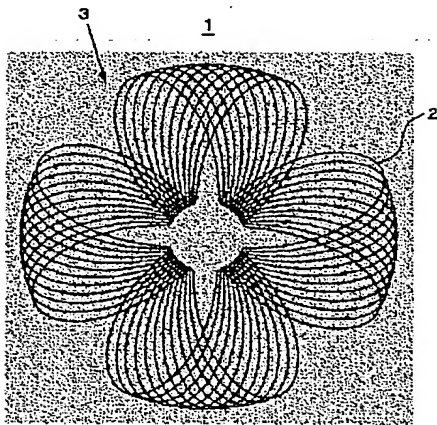【図7】実施例1の別の印刷物のフーリエ変換パターンを示す図である。
【符号の説明】
1　証券用線画
2　細画線

3　彩紋エレメント
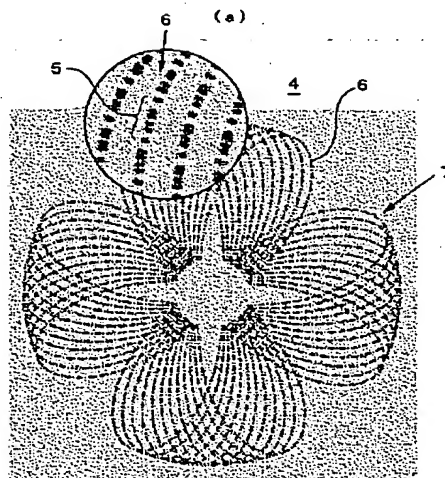4　実施例1の印刷物
5、5A、5B、5C　ユニット
6、13　ユニット画線
7、14　ユニット画線群
8　情報用分断線
9　始端分断線
10　終端分断線
11　実施例1の別の印刷物
12　実施例1の別のユニット
15、16　フーリエ変換画像

【図1】

【図2】

【図3】

【図4】

【図5】

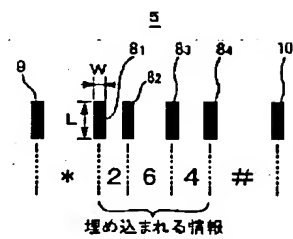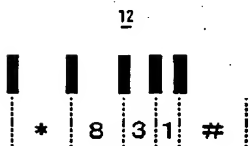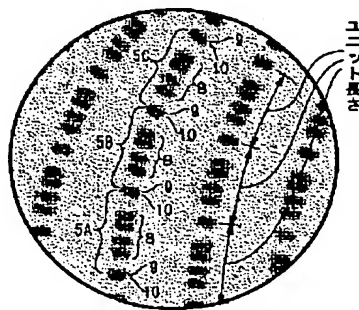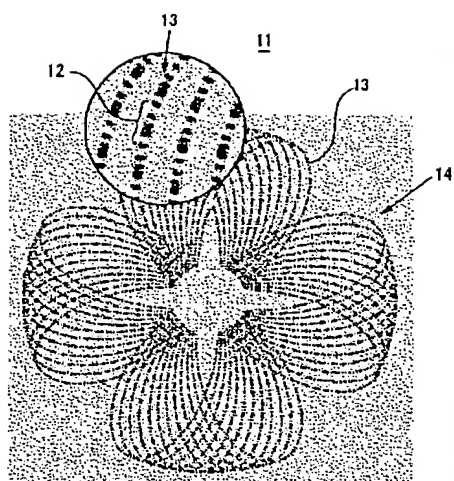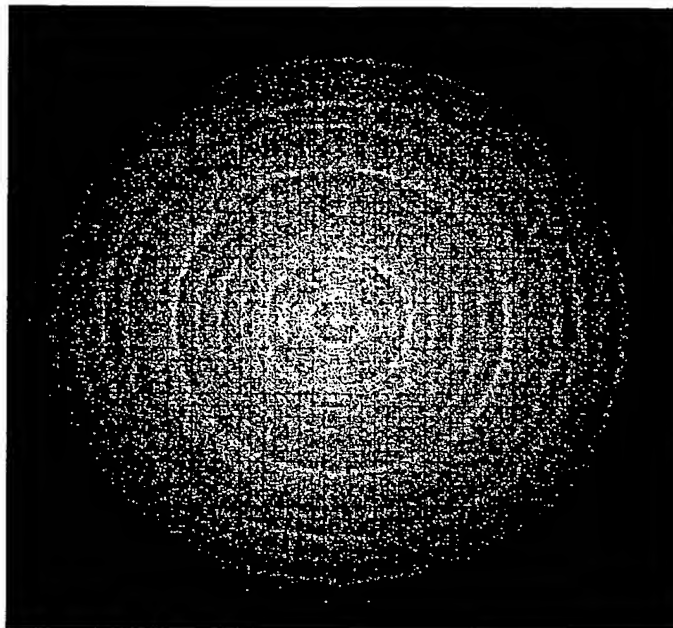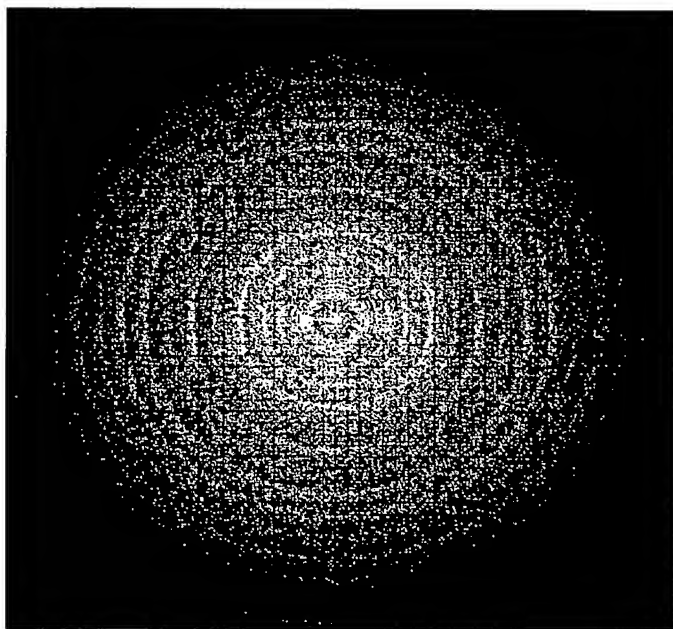【図6】

15

【図7】

16

フロントページの続き

Ｆターム（参考）　2C005　HA02　HB10　JB19　JB25
　　　　　　　　　2H113　AA01　AA06　CA39　CA40
　　　　　　　　　5B057　AA11　CA08　CA12　CA16　CB08
　　　　　　　　　　　　　CB12　CB16　CB18　CE08　CG05
　　　　　　　　　　　　　CG07
　　　　　　　　　5C076　AA14　BA06

THIS PAGE BLANK (USPTO)

19)

PATENT ABSTRACTS OF JAPAN

(21) Application number: **2002050606**

(22) Application date: **27.02.02**

(51) Intl. Cl.: **B41M 3/14 B42D 15/10 G06T 1/00 H04N 1/387**

(30) Priority:

(43) Date of application publication: **02.09.03**

(84) Designated contracting states:

(71) Applicant: **NATIONAL PRINTING BUREAU**

(72) Inventor: **KIUCHI MASATO**
SAITO KAZUHARU
FUJITA MINORU

(74) Representative:

(54) **TRUTH OR FALSEHOOD DISCRIMINABLE PRINTED MATTER, AND METHOD FOR DISCRIMINATING, AND METHOD FOR EMBEDDING INFORMATION IN PRINTED MATTER**

(57) Abstract:

PROBLEM TO BE SOLVED: To realize a truth or falsehood discriminable printed matter according to a Fourier transformation pattern of a printing line drawing obtained by embedding various information not visually recognized by a person in a fine printing element for constituting the line drawing for securities without reducing an artistic effect of the printing element.

SOLUTION: The truth or the falsehood is discriminable by constituting the fine line drawing 2 for constituting the line drawing 1 for the securities of a unit printing element 6 in which units 5 each made of a plurality of dividing lines 8 are continuously disposed, changing an interval of disposing the lines 8 in each unit 5, thereby Fourier transforming the printed matter 4 in

which the information is embedded, extracting a correlation of the int●●l of disposing the lines 8 as a peak● strength of the Fourier transforming pattern.
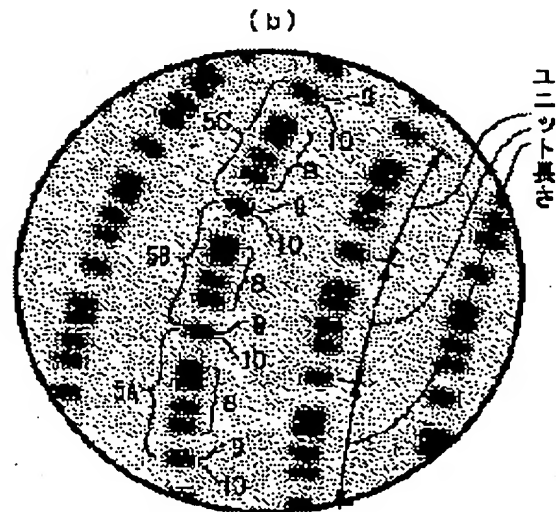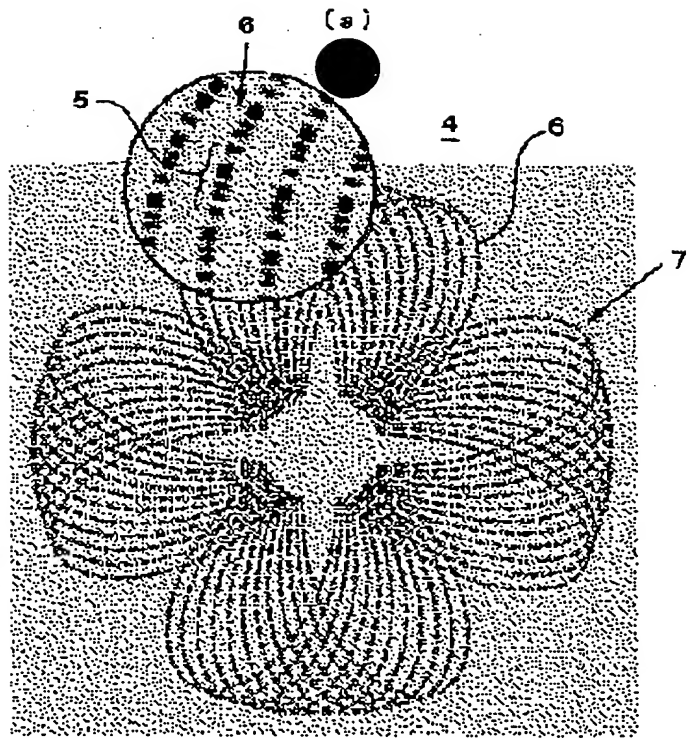
(a)

(b)

THIS PAGE BLANK (USPTO)

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to printed matter, such as negotiable securities, such as a bank note in which truth distinction is possible, a stock certificate, and a debenture, various certificates, and an important document.
[0002]
[Description of the Prior Art] In printed matter, such as negotiable securities, such as a bank note, a stock certificate, and a debenture, various certificates, and an important document, forgery and an alteration preventive measure are important elements. Forgery of these printed matter and an alteration preventive measure have the method of using for a design the pattern which mainly multiple-use-ized the geometrical pattern, and the method which appears the latent image which has not been visually recognized if a certain means and operation were added to printed matter.
[0003] Although geometrical patterns, such as a design widely used for designs, such as security printed matter, a **** pattern, and a relief pattern, are used for the former typical example, it constitutes the pattern by set of the music streak by fixed streak width of face fundamentally as the forgery and the alteration preventive measure using the aforementioned geometrical pattern.
[0004] Use the color which these patterns consider design nature, such as a design of printed matter, and is hard to be reproduced in the extraction or the copying machine by photoengraving-process equipment, or Although a role of a forged preventive measure is raised by making it a complicated music streak and generating moire to scanning I/O of a copying machine and a scanner There is a fault of having not brought about sufficient forgery and the alteration prevention effect with the advent of the photoengraving-process equipment which had advanced features recently, or a copying machine.
[0005] Moreover, the forgery and the alteration preventive measure which are used among the typical examples of the latter which adds a certain means and operation to the aforementioned printed matter It is that which a latent image appears when the latent image given into printed matter cannot recognize visually and copies with a copying machine with a series of technology generally called a copy prevention streak. In the printed matter suitable for the forged prevention by such copying machine, there is a technical means of ** of a degree already indicated - **.
[0006] ** There is printed matter (JP,57-20395,A) which gave the latent image suitable for the forged prevention by the copy which displayed the character which consists of a topography element which is the half tone dot of 30% of 85 lines on the base paper front face.
[0007] ** There is printed matter (JP,60-79991,A) suitable for the copy prevention which finished the printed matter front face with sufficient appearance by printing a latent image by the half tone dot on the surface of a form, carrying out simultaneous printing of the background of a latent image and this concentration by 10,000 lines, and piling up, printing and making an ornament pattern the upper surface of a latent image including a background in the transparency ink of the thin color of the grade which is not reproduced by the copy.
[0008] ** By giving heavy printing of the light color which is not reproduced by the form front face with a copying machine using the overprint version equipped with the wave pattern which consists of parallel lines which form a moire pattern when it interferes with 10,000 lines of a background Since the moire pattern which dazzles a naked eye is formed, the front face of printed matter becomes difficult [existence of a latent image] to discriminate, and when it applies to a copying machine, a latent image and a wave pattern have the

latent-image camouflaging meth⬤r copy prevention (JP,60-87380,A) onl⬤ackground is reproduced without being reproduced.

[0009] However, since each method of the above-mentioned ****** had to be the screen pattern which consists of roughness and fineness of points, such as a half tone dot or 10,000 lines, and a line, it had the fault of not being suitable for using for the existing products, such as negotiable securities, such as a design, a bank note which is using the **** pattern abundantly, a stock certificate, and a debenture.

[0010] Invention-in-this-application persons consider as the method with which the fault which the method of the above-mentioned ****** has is suppliable enough, and have already introduced the technical means of ** of a degree, and **.

[0011] ** The streak more than the double lines of the portion which expressed the portion which gave single stroke lines and the latent image for the portion which does not give a latent image for the set pattern of a music streak by the streak more than double lines, and gave the latent image The streak width of face of the sum total of the streak more than double lines is equal to the streak width of face of the streak of the single stroke lines of a portion which do not give a latent image. Branch from the single stroke lines of a portion which do not give a latent image, and and the boundary line on the streak of the portion which does not give a latent image, and the portion which gave the latent image further It applied for the creation method of the copy prevention pattern characterized by the straight line which crosses an abbreviation right angle, and the bird clapper, and its printed matter (Japanese Patent Application No. No. 206140 [six to]) to the straight line which touches a basic curve in the intersection of the basic curve which constitutes the set pattern of a music streak, and the border line of a latent image.

[0012] ** In a round term of the streak section on the sum total of the fixed-cycle rupture line of the portion which expressed the portion which gave the solid line and the latent image for the portion which does not give a latent image by the fixed-cycle rupture line to the set pattern of a music streak, and gave the latent image to it real-printed, and the non-streak section which severs and lacks the streak section The area of the non-streak section was added to the area of the streak section, and by the same length of the curve-like direction of the portion which gave the latent image, and the portion which does not give a latent image, the printed matter (Japanese Patent Application No. 7-138879) made into the rate of the same streak area was invented, and it applied.

[0013] The creation method of a copy prevention pattern and printed matter which gave forgery by the copying machine and the alteration prevention effect to the set pattern of music streaks, such as designs, such as negotiable securities, such as a bank note which needs copy prevention, a stock certificate, and a debenture, various certificates, and an important document, a **** pattern, and a relief pattern, with the printed matter which has the pattern of these ****s were able to be offered.

[0014] However, it is the present condition that it is becoming impossible for the copy preventive measure of ˙he method of the above-mentioned **** to grow into sufficient forged preventive measure by advanced features of a color copying machine and the advancement of DTP (desktop publishing) technology by the end of today.

[0015] Then, in truth distinction, extensive and the machine reading inspection method which can carry out high-speed processing are widely adopted as solution of such a problem. such technology in_which of the machine reading inspection method of today printed matter detect the material by functional ink , such as a magnetic ink , infrared reflective absorption ink , and fluorescent ink , the fiber which form a print media , the quality of the material and chemicals , etc. originate in the specific electromagnetic wave which sense to human being , and what a thing be dependent on material fitness when produce a printed matter give them only to only the product with which economical efficiency balance in many and a production cost side

[0016] Moreover, there is the optical reading method for the pattern on the printed matter which can apply printing material like the ink for general printing which can carry out visible as a method of not taking into consideration especially the production cost of printed matter. As the comparatively easy optical reading method, although OCR, OMR, a bar code, a 2-dimensional code, etc. are well-known, when using these optical reading methods for the existing product, change of a design and specification is required.

[0017] Moreover, it is also the method which has appeared on the market in the city widely, and since these optical reading methods can carry out visible [of the sign] as a printing streak, the danger of decode and an alteration is also expected and they are inadequate as forgery and the alteration prevention method.

[0018] Furthermore, there is ●es of technology generally called elect●watermark as a method of giving the information for reading, without similarly changing design nature, such as a design, by the optical reading method. An electronic watermark is also called concealed DOIMEJI and digital watermark, and is technology which embeds copyright information at the document file in the high performance copy technology and high performance DTP technology, or its printed matter as main uses. As well-known typical technology in printed matter, it is the method called frequency use type.

[0019] An electronic watermark is said for there to be little degradation of the frequency characteristic also in a duplicate object, and, recently, is given to the digital image distributed on the Internet for the purpose of protection of copyrights in many cases. Moreover, since the effect is done so also in printed matter, it has also been used for the poster etc. more often.

[0020] It is a continuous tone (photograph gradation) pattern that an electronic watermark can demonstrate an effect most. A continuous tone (photograph gradation) pattern is one of the technology in which many methods, such as not only a frequency use type but a pixel substitution type, a pixel space use type, a quantization error diffusion type, etc., are proposed since it is multiple-value image data and sufficient redundancy exists, and many reference and patent application also attract attention today.

[0021] However, since the set pattern of music streaks, such as a design used for negotiable securities, a **** pattern, and a relief pattern, is a binary picture fundamentally and there is little redundancy, embedding of an electronic watermark is made difficult, since the signal for reading is weak as a result, it reads, and the thing with a low precision has been a technical problem.

[0022] Therefore, development of the effective technology which can carry out truth distinction of a pattern that it has the forged prevention aptitude which is the forgery and the alteration prevention method independent of the material aptitude of printed matter, for example, is suitable for negotiable securities, such as a bank note, a stock certificate, and a debenture, various certificates, an important document, etc., by machine reading is desired.

[0023]

[Problem(s) to be Solved by the Invention] this invention was made in view of the above-mentioned point, and it aims at embedding information in the printed matter which has art, such as securities which consist of line drawings for securities, by giving a modulation to the line drawing for securities on the level which human being cannot recognize visually, without spoiling the artistic effect.

[0024] By the way, this invention person etc. has already proposed invention about the printed matter and the distinction method of already constituting the thin streak of the line drawing for securities from the division streak section which consists of two or more division lines arranged in parallel by the longitudinal direction at the predetermined intervals in which truth distinction is possible, and the information embedding method as an application for patent No. 1519 [2002 to]. Invention concerning this application to precede is technology which decides the width of face and length of the division line to be human being's eyes so that the division streak section and the usual thin streak may look equivalent, carries out the Fourier transform of this, recognizes peculiar frequency in the Fourier transform pattern, and is applied to truth distinction etc.

[0025] However, in this invention to precede, two or more division lines of the division streak section which constitutes the thin streak of the line drawing for securities are only arranged in parallel in the longitudinal direction at the fixed interval, and the information which can be given is limited to the kind of peculiar invisibility frequency, and cannot give many variations. then, let it be a technical problem to make it possible to embed information various finer again and to heighten the forged prevention effect in this invention, without devising the interval of arrangement of this division line, forming a thin streak, and spoiling the artistic effect -- [0026]

[Means for Solving the Problem] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible unit streaks by which two or more units have been arranged continuously. two or more above-mentioned units It consists of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-

mentioned unit makes It is set up ●esponding to the information embedde● ●pectively, and the information embedded the account of a top offers the printed matter which is characterized by the identifiable thing and in which truth distinction is possible with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained.

[0027] The composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes is the same about two or more above-mentioned units of all.

[0028] The digital image data in which an output of the printed matter which has the line drawing for securities which consists of two or more thin streaks is possible in order that this invention may solve the above-mentioned technical problem are created. It is the information embedding method of the printed matter which changes two or more above-mentioned thin streaks in the above-mentioned digital image data so that it may consist of visible unit streaks by which two or more units have been arranged continuously, and embeds predetermined information and in which truth distinction is possible. Two or more above-mentioned units are formed from the invisibility plurality fragmentation line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Under the present circumstances, two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes It sets up corresponding to the information embedded, respectively, and the information embedding method of the printed matter which is characterized by making identifiable the information embedded the account of a top with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained and in which truth distinction is possible is offered.

[0029] It is characterized by similarly forming the composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes about two or more above-mentioned units of all.

[0030] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible unit streaks by which two or more units have been arranged continuously. two or more above-mentioned units It consists of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes It is the truth distinction method of the printed matter which is set up corresponding to the information embedded, respectively and changes and in which truth distinction is possible. The Fourier transform of the digital image data of the above-mentioned printed matter is carried out, a Fourier transform pattern is created, and the truth distinction method of the printed matter which is characterized by discriminating the information embedded the account of a top by this Fourier transform pattern and in which truth distinction is possible is offered.

[0031] Composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes is characterized by being the same about two or more above-mentioned units of all.

[0032] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible division streaks which consist of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes It is set up, respectively and the information embedded the account of a top offers the printed matter which is characterized by the identifiable thing and in which truth distinction is possible with the Fourier transform pattern with which the Fourier transform of the digital image data of the

above-mentioned printed matter carried out, and they are obtained so that predetermined information may be embedded at the above-mentioned line drawing for securities.

[0033] The digital image data in which an output of the printed matter which has a line drawing for securities from two or more thin streaks, and in which truth distinction is possible is possible in order that this invention may solve the above-mentioned technical problem are created. It is prolonged in the direction which intersects the above-mentioned thin streak perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively. And it changes so that it may consist of visible division streaks which consist of the invisibility plurality division line arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which is the information embedding method of the printed matter which embeds predetermined information, and in which truth distinction is possible, and adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes so that predetermined information may be embedded at the above-mentioned line drawing for securities It sets up, respectively and the information embedding method of the printed matter which is characterized by making identifiable the information embedded the account of a top with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained and in which truth distinction is possible is offered.

[0034] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible division streaks which consist of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes As predetermined information is embedded at the above-mentioned line drawing for securities, it is the truth distinction method of the printed matter in which truth distinction is possible which is set up, respectively and changes. The Fourier transform of the digital image data of the above-mentioned printed matter is carried out, a Fourier transform pattern is created, and the truth distinction method of the printed matter which is characterized by discriminating the information embedded the account of a top by this Fourier transform pattern and in which truth distinction is possible is offered.

[0035]

[Embodiments of the Invention] The form of operation of the printed matter concerning this invention, the distinction method, and how to embed the information on this printed matter is explained to a detail below with reference to a drawing based on an example. Two or more streaks containing the straight line (direct 10,000 lines) and curve of 10,000 lines gather, and the line drawing for securities currently used for securities, the bill, etc. consists of geometric designs. The streak used as the element which constitutes such a line drawing for securities is called "thin streak" by this invention. In the line drawing for securities, very high regularity exists in the interval of two or more thin streaks etc.

[0036] Paying attention to this regularity, this invention evaluates the interval of two or more thin streaks of the line drawing for securities, and correlation of a position, and utilizes them as a means of truth distinction.

[0037] Furthermore, with digital instruments, such as a scanner and a copying machine, although it is identifiable, two or more thin streaks which constitute the line drawing for securities which has this regularity from this invention Give a modulation and embed information so that a detailed portion (a part for " mentioned later open-circuit") with difficult recognition may be put in order and constituted from a visual sense for human being, and the printed matter obtained by doing in this way is changed into a digital image. a digital instrument (specifically computer) top -- the interval of the line drawing for securities and a position, and the above -- truth distinction is enabled by analyzing correlation by arrangement of a detailed portion etc. and discriminating the information embedded at printed matter

[0038] As composition which gives a modulation to the line drawing for securities on the level which cannot be recognized with human being's visual sense, this invention is making a part or all of a thin streak that constitutes the line drawing for securities the composition formed by the unit streak which consists of two or more units. Such a unit streak serves as two or more meeting unit streak group, and forms the line drawing for securities.

[0039] The length (henceforth "u⬤ngth") of two or more units is made in⬤e predetermined length decided beforehand, and constitutes each unit from two or more invisibility division lines. Two or more of these division lines are prolonged in the direction which intersects perpendicularly with the center line of a thin streak, respectively, and are considered as the composition arranged by standing in a row in the direction of a thin streak, and are considered as the composition which embeds information by setting up suitably the mutual interval to the direction of a thin streak, and arranging two or more division lines in this unit (deciding the interval of the arrangement to the direction of a thin streak of two or more division lines.). That is, two or more intervals which the part open circuit which adjoins mutually among two or more division lines in a unit makes are set up corresponding to the information embedded, respectively.

[0040] In short, this invention forms the thin streak which constitutes the line drawing for securities which is original drawing by the unit streak. this unit streak with human being's visual sense, the thin streak and concentration of original drawing are equivalent, it considers as the composition whose line drawing for securities can be seen like original drawing, and the part open circuit which constitutes a unit serves as invisibility -- as -- the length (the length of the fragmentation line to the direction which intersects perpendicularly with the center line of a thin streak --) of a fragmentation line and width of face (the width of face of the fragmentation line to the direction where a thin streak is prolonged --) A further mutual interval is decided. And it is considering as composition where predetermined information is embedded by setting up the mutual interval of the fragmentation line in a unit suitably, and arranging it based on the regularity (the interval and direction of two or more thin streaks of the line drawing for securities.) of the line drawing for securities.

[0041] Thus, in order to discriminate the embedded information and to carry out truth distinction of printed matter, from this Fourier transform pattern, the Fourier transform is performed about the line drawing for securities which consists of unit streak groups which consist of two or more unit streaks, the information about arrangement of the unit length on the line drawing for securities and the part open circuit in a unit is extracted, the embedded information is extracted and discernment is presented.

[0042] Furthermore, the thin streak from which this invention constitutes the line drawing for securities of printed matter does not make a unit a unit as mentioned above, constitutes it from a fragmentation streak which two or more fragmentation lines are arranged and changes, two or more fragmentation streaks gather, and it constitutes a fragmentation streak group, and also includes the printed matter which displays the line drawing for securities of printed matter, the distinction method, and how to embed the information on this printed matter by this fragmentation streak group.

[0043] (Example 1) The example 1 of the printed matter concerning this invention, the distinction method, and how to embed the information on this printed matter is explained. Drawing 1 is an example of the line drawing for securities used as original drawing of the printed matter concerning this invention. Although this line drawing 1 for securities has the **** element 3 which consists of the printed thin streak 2, it can recognize this thin streak 2 or the **** element 3 with human being's visual sense.

[0044] Based on the **** element 3 of this line drawing 1 for securities, the printed matter 4 of the example 1 of this invention shown in drawing 2 (a) is created. Printed matter 4 is a picture which two or more thin streaks 2 which constitute the **** element 3 are formed by the unit streak 6 which consists of the unit 5 of two or more same composition, respectively, and the **** element 3 is drawn by the unit streak 6, and changes. In short, the **** element 3 is expressed as the unit streak group 7 in which two or more unit streaks 6 gathered. This unit streak 6 of the interval and direction of streaks is completely the same as that of the thin streak 2 of original drawing.

[0045] the inside of the circle of drawing 2 (a) -- a part of unit streak 6 -- the enlarged view is shown One unit streak 6 in this enlarged view is expanded further, and drawing 2 (b) shows it. Each units 5A, 5B, and 5C which constitute the unit streak 6 are the same composition mutually, have the predetermined length (it is called "unit length".) decided beforehand, and consist of two or more division lines. Specifically, Units 5A, 5B, and 5C consist of two or more part open circuits 8 for information which embed information, respectively, and the start edge part open circuit 9 of both sides and the termination part open circuit 10 of the part open circuit 8 for information.

[0046] By the way, although the unit 5 of two or more same composition is repeatedly arranged continuously in this example 1 and the unit streak 6 is constituted, the units 5A and 5B which adjoin mutually are sharing

the start edge part open circui●nd the termination part open circuit 10. ●awing 2 (b) is explained for this as an example, the termination part open circuit 10 of unit 5A is shared by both the units 5A and 5B as start edge part open circuit 9 of unit 5B, and the termination part open circuit 10 of division line 5B is shared by both the units 5B and 5C as start edge part open circuit 9 of unit 5C.

[0047] Although the unit 5 is considered as the composition which embeds predetermined information, drawing 3 is drawing showing the concrete composition of the unit 5 which embedded predetermined information. Between the start edge part open circuit 9 and the termination part open circuit 10, the part open circuits 81-84 for information of four are arranged, and this unit 5 is constituted. Predetermined information is embedded by deciding suitably the mutual interval of the part open circuits 81-84 for information of four.

[0048] Corresponding to the information element (example . signs, such as a number) which constitutes the information embedded beforehand, the interval is decided beforehand. By this example 1, an information element is made into a decimal digit and a corresponding example of an interval is shown in the next table 1. Although * and ** express an identifier among this table 1, respectively and being later mentioned about the need, identifier * corresponds to the interval of the start edge part open circuit 9 and the part open circuit 81 for information, and identifier ** corresponds to the interval of the termination part open circuit 10 and the part open circuit 84 for information.

[0049]

[Table 1]

情報／識別子	0	1	2	3	4	5	6	7	8	9	*	#
間隔（μm）	50	60	70	80	90	100	110	120	130	140	150	160

[0050] In order to embed the information which consists of the combination of the decimal digit "264" about a unit 5 based on this table 1 The interval of 150 micrometers, the part open circuit 81 for information, and the part open circuit 82 for information for the interval of identifier * and the part open circuit 81 for information 70 micrometers, What is necessary is to arrange the interval of 110 micrometers, the part open circuit 83 for information, and the part open circuit 84 for information to 90 micrometers, and just to arrange the interval of the part open circuit 84 for information, and identifier ** for the interval of the part open circuit 82 for information, and the part open circuit 83 for information to 160 micrometers, respectively.

[0051] Unit length is set to 580 micrometers which is the value which totaled these intervals. Two or more units 5 of such composition are continuously repeated along with the thin streak 2 (refer to drawing 1) of original drawing, and the unit streak 6 is arranged and constituted.

[0052] Here, the need of arranging identifier * and identifier ** in a unit 5 is explained. Although the printed matter concerning this invention is mentioned later and it performs the discernment with meanses, such as pattern matching, as a Fourier resolution picture, since a picture will appear symmetrically if information "264" is checked by the Fourier resolution picture, it will show the same position and same intensity as what carried out the Fourier resolution picture of the information "462", and distinction of it becomes impossible.

[0053] Then, in order to enable this distinction, make identifier * correspond to the interval of 150 micrometers, identifier # is made to correspond to the interval of 160 micrometers, it registers with Table 1 with an information element, and the identifier to which * expresses an informational start, and # are used as an identifier showing an informational end, respectively. It turns out that it will be set to "*462" if "*264" can be replaced on a par with "264*" if "*462" is compared with "*264" and it reads from opposite direction still as mentioned above when using only identifier * showing an informational start here and not using identifier # showing an informational end namely, and "*264" and "*462" become the same Fourier transform pattern. Then, if identifier # showing an informational end is used, since "*264#" and "*462#" do not become the same pattern, they will become discriminable [both].

[0054] In the line drawing 1 for securities of original drawing shown in drawing 1 , the width of face (size of a line) of the thin streak 2 is 55 micrometers. Although the fragmentation lines 8-10 of a unit 5 are invisible at human being's eyes, respectively when it is created as printed matter which formed the thin streak 2 by the unit streak 6, as shown in drawing 2 (a) The unit streak 6 needs to adjust the interval of the fragmentation lines 8-10, and the size (width of face W and length L) of a fragmentation line, in order to make it visible by human being's eyes like the thin streak 2 of the line drawing 1 for securities which is original drawing. Specifically according to the interval of the fragmentation lines 8-10, the size (width of face W and length L)

is adjusted.

[0055] In this example 1, if the interval during the part open circuit corresponding to information "*264#" is equalized, it will be set to /(150micrometer+70micrometer+110micrometer+90micrometer+160micrometer)5=116micrometer. Corresponding to the numeric value of 116 micrometers, the interval of the average between this fragmentation line can set each width of face W of all the fragmentation lines of the part open circuit for information, a start edge part open circuit, and a termination part open circuit to 30 micrometers, and can set up length L with 293 micrometers. Even when the unit streak 6 is visible to human being by making the fragmentation line of a unit 5 into such a size, the fragmentation lines 8-10 will be in an invisible state.

[0056] By the way, although these people are not the technology which forms the thin streak 2 by unit streak 6 like this invention, in the negotiable securities which perform truth distinction by machine read, they constitute a part of thin streak from a fragmentation line, and have already performed patent application about the technology which invisibility-izes this fragmentation line more completely (refer to JP,2000-118121,A.). the part open circuit in this invention if this invisibility-ized technology is applied to this invention -- more -- completeness -- invisibility-ization is attained

[0057] The outline of the technology which invisibility-izes this fragmentation line is as follows. In case it decides in the length of a fragmentation line, the average of an interval with the part open circuit adjoined before and behind the fragmentation line is computed, and the width of face and length corresponding to this average are determined. The unit 5 shown in drawing 3 explains concretely the composition which applied this technology to this invention.

[0058] For example, it is performed as follows when deciding the width of face and length of the part open circuit 81 for information. The interval between the start edge part open circuit 9 and the part open circuit 81 for information (interval corresponding to identifier *) is 150 micrometers, and the interval (interval corresponding to an information element "2") of the part open circuit 81 for information and the part open circuit 82 for information is 70 micrometers. The average of 110 micrometers of the interval of 150 micrometers of the both sides of this part open circuit 81 for information and 70 micrometers is computed, and suppose the width of face of the part open circuit 81 for information that the width of face and length in the case of becoming fixed at intervals of [of 110 micrometers] a fragmentation line are given.

[0059] As mentioned above, the thin streak 2 of the line drawing 1 for securities of original drawing shown in drawing 1 is formed by the unit streak 6. In order to display the line drawing for securities shown in drawing 2 (a) by the unit streak group 7 which is a set of the unit streak 6 Read the line drawing 1 for securities with digital instruments, such as a scanner, first, and it considers as digital image data, such as bit map data. this -- illustrating -- the thin streak 2 is processed with software (for example, general BAL chewiness stem as illustrator marketed from Adobe), and it transposes to the unit streak 6

⌐0060] or a computer -- illustrating -- you may create directly the digital image of the line drawing for securities shown in drawing 2 (a) displayed by the unit streak group 7 using software make it any -- if the printout of this digital image is carried out, the printed matter shown in drawing 2 (a) should just be created In this invention, since it does not consider as the summary of invention of the method of such illustrating of printed matter itself, explanation of this point is omitted.

[0061] Two or more unit streaks 6 which consist of two or more above units 5 gather, serve as the unit streak group 7, and display the line drawing for securities. These unit streak groups 7 have different spatial frequency based on the mutual interval of two or more unit streaks 7, moreover, information "*264#" is embedded to the unit 5, and if the printout of this is carried out, by appearance, the printed matter 4 concerning this invention which does not change in the line drawing 1 for securities shown in drawing 1 in which truth distinction is possible will be created.

[0062] Based on Table 1, in order to create the printed matter 11 which has the unit 12 which similarly embedded another information "*831#" at the same line drawing 1 for securities shown in drawing 1 , as shown in drawing 4 , each interval of the start edge part open circuit 9, information fragmentation 8 line, and the termination part open circuit 10 is decided, and a unit 12 is created so that it may correspond to information "*831#." The unit length of this unit 12 is 580 micrometers like printed matter 11.

[0063] And by the unit streak 13 which continues in the direction of plurality and a thin streak, and is repeatedly constituted in this unit 12, the thin streak 2 of original drawing 1 can be formed, and the printed

matter 11 which displays the ⬤rawing for securities by the unit streak ⬤p 14 for which the unit streak 13 as shown in <u>drawing 5</u> gathered can be created.

[0064] Next, the means and method of discriminating the information concerned on the printed matter with which information was embedded by above how embedding information are explained. The above-mentioned printed matter 4 and 11 is read by readers, such as a scanner, and a reading result is held as bit map data (it is an example of the "digital image data" of this invention.). And the Fourier transform of this bit map data is carried out.

[0065] The Fourier resolution picture 15 of the printed matter 4 of this example is shown in <u>drawing 6</u> , and the Fourier resolution picture 16 of printed matter 11 is shown in <u>drawing 7</u> , respectively. The correlation based on enlargement explains how it appears in a Fourier transform pattern about each of the information "*264#" embedded for the example in these Fourier resolution pictures 15 and 16, and information "*831#."

[0066] In the Fourier resolution pictures 15 and 16 of printed matter 4 and 11, the peak position in a Fourier transform pattern is observed by the same frequency. That is, both unit length in printed matter 4 and printed matter 11 is 580 micrometers, and the peak is observed by the position of the frequency corresponding to this unit length, and the position of the integral multiple of this frequency. Discernment of the embedded information is not attached at this point.

[0067] However, the intensity of the peak in the Fourier transform pattern of printed matter 4 and printed matter 11 differed in both, and the difference among both has appeared notably especially in the 4th peak (a center to the 4th ring). In the unit 5 of printed matter 1, and the unit 12 of printed matter 4, although the intervals of arrangement of the part open circuit for information differ in order to embed information ("*264#", "*831#") different, respectively, it originates in this and the intensity of the 4th peak differs.

[0068] That is, if it is the same unit length, although a peak will be observed by the frequency position where a Fourier transform pattern is the same, if the intervals of arrangement of the part open circuit for information in a unit differ, peak intensity differs. Therefore, the interval of arrangement within the unit of the part open circuit for information concerning the information embedded to printed matter can be recognized based on this Fourier transform pattern. If it is made equivalent to the information which the interval of arrangement of this part open circuit for information embedded, embedding of the predetermined information on a printing streak and its reading will be realized.

[0069] By the way, although there are some concrete meanses to discriminate the embedding information on the printed matter concerning this invention from a Fourier transform pattern, they mention three meanses here.

(1) In reading image processing systems, such as a computer, make the Fourier transform pattern corresponding to predetermined embedding information memorize beforehand, and discriminate the Fourier transform pattern of the bit map data read in printed matter as compared with this Fourier transform pattern memorized beforehand (pattern matching).

[0070] (2) Prepare beforehand the concentration distribution curve (the concentration distribution curve which serves as the k-th peak from the inside among the peaks in a Fourier transform pattern is said.) of the k-th peak of the Fourier transform data corresponding to predetermined embedding information, and compare this with the concentration distribution of the Fourier transform data of the bit map data read in printed matter of the k-th peak.

[0071] (3) Calculate on-the-strength I (k) in the k-th peak position of the Fourier transform pattern of the bit map data read in printed matter by the following several 1.

[0072]

[Equation 1]

$$I(k) = N \left\{ \sum_{i,j=1}^{n} \cos 2\pi k x_{ij} \right\}^2 \quad \cdots (1)$$

[0073] The numeric value which standardized the interval of the i-th fragmentation line in the unit 5 to which the number of the units 5 which N has in the whole streak, and n are given to by the number of the fragmentation line in a unit 5 here, and x_{ij} is given by the following several 2, and the j-th fragmentation line by unit length is expressed.

[0074]

[Equation 2]

$$x_{ij} = (d_j - d_i) / \sum_{s=1}^{n} d_s \quad \cdots (2)$$

[0075] By these formulas (1) and (2), if the value of on-the-strength I (k) in the k-th peak position of a Fourier transform pattern is recognized, by solving simultaneous equations, it can become possible to ask for arrangement of the fragmentation line in a unit easily, and can embed by this, and information can be discriminated.

[0076] Discernment of the printed matter 1 which has as an example the unit 5 which embedded information "*264#" is explained. The digital image of this printed matter 1 is read, and the Fourier transform is performed, and suppose that the Fourier transform pattern was obtained. In a reader, the primary peak position of the FFT shows immediately that unit length is 580 micrometers.

[0077] And it is possible by reading the relative intensity of primary -- [secondary / 3rd] and the Fourier transform pattern in the n-th peak, respectively, applying this to more than one above 2, and solving simultaneous equations with the least square method to solve the list of arrangement of the division part open circuit in a unit 5, i.e., the interval of a fragmentation line.

[0078] When the interval which the start edge part open circuit 9, the part open circuits 81-4 for information, and the termination part open circuit 10 adjoin mutually can be found with 150 micrometers, 70 micrometers, 110 micrometers, 90 micrometers, and 160 micrometers and discriminates a decimal digit from these simultaneous equations based on Table 1, it is discriminable that the embedded information is "*264#." In addition, it is identifiable similarly about the printed matter 2 which embedded information "*831."

[0079] As mentioned above, informational embedding and reading are possible by giving a variation to a fragmentation line, since the peak intensity of a clear Fourier transform pattern is obtained also in an example by which signs, such as the same number, are repeated in a unit, and arranging regularly. Although the information which consists of the decimal digit of 3 figures was embedded in this example 1, according to this invention, even the number of what figure can express signs, such as a number, using a fragmentation line, and can be recognized from the Fourier transform pattern which has the frequency and intensity of a characteristic peak position corresponding to information, such as a number, for the result.

[0080] (Modification of an example 1) Here, the printed matter concerning the modification of the example 1 of this invention is explained below. This modification forms the thin streak 2 which constitutes the line drawing 1 for securities of original drawing shown in drawing 1 by the unit streak which consists of two or more units, and expresses the line drawing for securities of the **** element 3 as the unit streak group which is the meeting of a unit streak. The unit streak of the interval of streaks etc. of this printed matter is completely the same as that of the case of the thin streak of the line drawing 1 for securities of original drawing.

[0081] Two or more units are arranged continuously repeatedly, a unit streak is constituted, and two or more units have the same unit length mutually. A unit arranges in parallel two or more fragmentation lines prolonged in the direction which intersects perpendicularly with the center line of the thin streak 2 of original drawing in the direction of a thin streak, is constituted, and is taken as the composition which embeds information by this.

[0082] Although two or more fragmentation lines are arranged at the unit, and the length of this fragmentation line and width of face, and a further mutual interval are invisible in the fragmentation line itself, it is decided that the unit streak which consists of two or more units has equivalent thin streak 2 and concentration of original drawing, and the **** element 3 looks visually like the line drawing 1 for securities of original drawing.

[0083] By the way, although the interval (two or more intervals which the part open circuit which adjoins mutually among two or more fragmentation lines in a unit makes) of arrangement of two or more fragmentation lines of a unit is decided and predetermined information is embedded arrangement of two or more fragmentation lines within each unit in two or more units which constitute a unit streak from an example 1 -- each unit -- the same -- the unit with the arrangement of a fragmentation line same in short -- two or more repeats -- it is arranged continuously and the unit streak is constituted

[0084] However, the interval of arrangement of two or more fragmentation lines within each unit in two or

more units which constitute a ● streak from this modification may not ●sarily be the same about each unit. In short, two or more repeats per-continuum arrangement is carried out, and the unit whose arrangement of a fragmentation line is not necessarily the same constitutes the unit streak from this modification.

[0085] The printed matter concerning this modification is read with a scanner, and it opts for arrangement of a fragmentation line uniquely within two or more units, respectively so that the picture which carried out the Fourier transform of this as a digital image may serve as a predetermined Fourier transform pattern. In short, it is considering as the composition which embeds information by arranging a respectively original fragmentation line within two or more units so that a Fourier transform pattern may turn into a predetermined pattern.

[0086] thus, about two or more units of each which constitute a unit streak from printed matter of a modification It is what it opts for arrangement of two or more fragmentation lines uniquely, and two or more units by which arrangement of a respectively original fragmentation line was made are continuously arranged, a unit streak is constituted, and the line drawing for securities is displayed as by the unit streak group which is the meeting of a unit streak. The truth distinction is made in whether the Fourier resolution picture of printed matter matches the predetermined Fourier transform pattern.

[0087] By the way, a means to discriminate information from a Fourier transform pattern also about this modification is the same as an example 1, and is as follows. ** Match about the Fourier resolution picture of a predetermined Fourier transform pattern and predetermined printed matter memorized beforehand. ** Compare with the concentration distribution curve of the k-th peak of the Fourier transform data of printed matter the concentration distribution curve of the k-th peak of the predetermined Fourier transform data prepared beforehand. ** Compute and discriminate arrangement of a unit from the intensity in the k-th peak position of the Fourier transform data of printed matter.

[0088] (Example 2) The above-mentioned example 1 constitutes two or more units from the unit streak which follows a longitudinal direction, and arranges and grows into it by making into a unit the unit which has a fragmentation line for a thin streak. However, it is good also as composition which does not make a unit a unit for a thin streak. From this viewpoint, this invention person etc. hit on an idea of the example 2 of this invention.

[0089] That is, the thin streak which constitutes the line drawing for securities of the printed matter concerning an example 2 does not make a unit a unit like an example 1, and consists of fragmentation streaks which two or more fragmentation lines are arranged and grow into the longitudinal direction of a thin streak. And a fragmentation streak gathers, a fragmentation streak group is constituted, and the line drawing for securities of printed matter is displayed by this fragmentation streak group.

[0090] Thus, two or more fragmentation lines used as the smallest unit of the component of the line drawing for securities are prolonged in the direction which intersects perpendicularly to the longitudinal direction of a thin streak, respectively, and are arranged in parallel along with the longitudinal direction of a thin streak. And although each length of a fragmentation line and width of face, and a further mutual interval are invisible in the fragmentation line itself, visually, a fragmentation streak has equivalent thin streak and concentration of original drawing, is the same as the line drawing 1 for securities of original drawing, and it is decided so that the **** element 3 can be seen.

[0091] Two or more intervals (mutual interval) which the part open circuit which adjoins mutually in the direction of a thin streak among two or more of these fragmentation lines makes are characterized by the composition set up, respectively so that predetermined information may be embedded at the line drawing for securities. This embedded information is identifiable by the Fourier transform pattern obtained by carrying out the Fourier transform of the digital image data which read the printed matter concerning this example 2 with the scanner, and were obtained. In short, two or more intervals which a fragmentation line makes are set up so that the information embedded may be identifiable by the Fourier transform pattern of the digital image data of printed matter.

[0092] The same thing is not contained for two or more intervals of all that the part open circuit mutually adjoined in the direction of a thin streak among two or more fragmentation lines for this example 2 embedding information, as for an important thing makes here. That is, the interval (pitch by which a minute open circuit is repeated) which two or more fragmentation lines make does not include uniform composition, but the information embedded is set up with the Fourier transform pattern of the digital image data of printed

matter, so that it may be identifi⬤ If the number of fragmentation lines is ⬤ e enough when the interval which two or more fragmentation lines make is chosen from for 50 to 150 micrometers at random using a random number and a fragmentation line is arranged here, even if it generates a fragmentation line what times, the same Fourier transform pattern will be obtained. On the other hand, if artificial artificiality is given to arrangement of a fragmentation line, the Fourier transform pattern differs from the aforementioned pattern. If a more concrete example is given, when setting up the kind of fragmentation line at intervals of 10 micrometers from 50 micrometers to 150 micrometers and arranging a fragmentation line using a random number from this inside, it sets up so that 80 micrometers may become the double precision of the selection probability of the fragmentation line of other intervals artificially. Thus, the Fourier transform pattern to the fragmentation line operated and arranged will produce a different Fourier transform pattern from the case where an interval is completely made into the fragmentation line chosen and arranged at random. The information embedded from this specific Fourier transform pattern can be extracted.

[0093] In short, the printed matter concerning an example 2 is considered as the composition which embeds information by completely arranging a division line uniquely within two or more units, respectively so that a Fourier transform pattern may turn into a predetermined pattern.

[0094] A means to discriminate the printed matter concerning this example 2 is the composition that truth distinction is performed by whether the predetermined Fourier transform pattern beforehand remembered to be the Fourier transform pattern obtained by carrying out the Fourier transform specifically matches and matches the digital image data which read the printed matter concerning an example 2 with the scanner, and were obtained by the comparator.

[0095] in addition, the thing for which the technology of performing invisibility-ization for the above-mentioned prior (referring to JP,2000-118121,A.) division line more completely is applied also in this example 2 in case the width of face of each division line, length, and a mutual interval are designed -- a division line -- more -- completeness -- invisibility-ization is attained

[0096] As mentioned above, although the form of operation of this invention was explained based on the example, it cannot be overemphasized by this invention that there are various examples within the limits of the technical matter which is not limited to such an example and indicated by the claim.

[0097]

[Effect of the Invention] Although the line drawing for securities can be recognized with human being's visual sense in the truth distinction printed matter concerning this invention which consists of the above composition With constituting the line drawing for securities from a unit streak which consists of the unit which has two or more division lines, invisible information can be embedded to human being. moreover, this embedding information artistic effect ****** which a printing streak has by reading the line drawing for securities as a digital image, performing the Fourier transform, and processing matching etc. since it is identifiable -- there are nothings and the forged prevention effect can be heightened

[0098] By this invention, the thin streak of original drawing of printed matter is especially formed by the unit streak which consists of the unit which has two or more division lines. Two or more intervals which the part open circuit which adjoins mutually among two or more division lines in a unit makes By making it set up corresponding to the information embedded, respectively Since it is simply identifiable in information, while it can embed information, and being able to heighten the forged prevention effect by the Fourier transform pattern of the digital image of this printed matter moreover Handling is convenient at a low cost and it is very useful as a means which embeds invisibility information in various fields, such as a bank note, securities, various certificates, and an important document.

[0099] and artistic effect ****** which a printing streak has since it is impossible to recognize the information with human being's visual sense also in monochrome printing in the streak used for this invention -- there are also nothings

[0100] Furthermore, when formation of a thin streak enables in this invention at the visible division streak which consists of the invisibility plurality division line instead of a unit unit, the interval (the pitch by which a minute open circuit is repeated) which two or more division lines make does not include uniform composition, but the information embedded sets up with the Fourier-transform pattern of the digital image data of printed matter so that it is identifiable, it can have flexibility more and the printed matter in which high truth distinction of the forged prevention effect is possible can realize.

CLAIMS

[Claim(s)]

[Claim 1] It is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible unit streaks by which two or more units have been arranged continuously. two or more above-mentioned units It consists of the invisibility plurality fragmentation line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes It is set up corresponding to the information embedded, respectively, and the embedded information is printed matter which is characterized by the identifiable thing with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained and in which truth distinction is possible the account of a top.

[Claim 2] The composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes is printed matter which is characterized by being the same about two or more above-mentioned units of all and in which truth distinction according to claim 1 is possible.

[Claim 3] The digital image data in which an output of the printed matter which has the line drawing for securities which consists of two or more thin streaks is possible are created. It is the information embedding method of the printed matter which changes two or more above-mentioned thin streaks in the above-mentioned digital image data so that it may consist of visible unit streaks by which two or more units have been arranged continuously, and embeds predetermined information and in which truth distinction is possible. Two or more above-mentioned units are formed from the invisibility plurality fragmentation line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Under the present circumstances, two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes The information embedding method of the printed matter which is characterized by making identifiable the information which set up corresponding to the information embedded, respectively and was embedded the account of a top with the Fourier transform pattern which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and is obtained and in which truth distinction is possible.

[Claim 4] The information embedding method of the printed matter which is characterized by similarly forming the composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes about two or more above-mentioned units of all and in which truth distinction according to claim 3 is possible.

[Claim 5] It is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible unit streaks by which two or more units have been arranged continuously. two or more above-mentioned units It consists of the invisibility plurality fragmentation line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes It is the truth distinction method of the printed matter which is set up corresponding to the information embedded, respectively and changes and in which truth distinction is possible. The truth distinction method of the printed matter which carries out the Fourier transform of the digital image data of the above-mentioned printed matter, and is characterized by discriminating the

information which created the F●transform pattern and was embedded ●count of a top by this Fourier transform pattern and in which truth distinction is possible.

[Claim 6] The composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned fragmentation lines in the above-mentioned unit makes is the truth distinction method of the printed matter according to claim 5 in which the truth distinction characterized by being the same about two or more above-mentioned units of all is possible.

[Claim 7] It is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible division streaks which consist of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes It is set up, respectively so that predetermined information may be embedded at the above-mentioned line drawing for securities, and the embedded information is printed matter which is characterized by the identifiable thing with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained and in which truth distinction is possible the account of a top.

[Claim 8] The digital image data in which an output of the printed matter which has a line drawing for securities from two or more thin streaks, and in which truth distinction is possible is possible are created. It is prolonged in the direction which intersects the above-mentioned thin streak perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively. And it changes so that it may consist of visible fragmentation streaks which consist of the invisibility plurality fragmentation line arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which is the information embedding method of the printed matter which embeds predetermined information, and in which truth distinction is possible, and adjoins mutually in the direction of a thin streak among two or more above-mentioned fragmentation lines makes so that predetermined information may be embedded at the above-mentioned line drawing for securities The information embedding method of the printed matter which is characterized by making identifiable the information which set up, respectively and was embedded the account of a top with the Fourier transform pattern which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and is obtained and in which truth distinction is possible.

[Claim 9] It is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible fragmentation streaks which consist of the invisibility plurality fragmentation line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which adjoins mutually in the direction of a thin streak among two or more above-mentioned fragmentation lines makes As predetermined information is embedded at the above-mentioned line drawing for securities, it is the truth distinction method of the printed matter in which truth distinction is possible which is set up, respectively and changes. The truth distinction method of the printed matter which carries out the Fourier transform of the digital image data of the above-mentioned printed matter, and is characterized by discriminating the information which created the Fourier transform pattern and was embedded the account of a top by this Fourier transform pattern and in which truth distinction is possible. * NOTICES *

TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to printed matter, such as negotiable securities, such as a bank note in which truth distinction is possible, a stock certificate, and a debenture, various certificates, and an important document.

[Description of the Prior Art] In printed matter, such as negotiable securities, such as a bank note, a stock certificate, and a debenture, various certificates, and an important document, forgery and an alteration preventive measure are important elements. Forgery of these printed matter and an alteration preventive measure have the method of using for a design the pattern which mainly multiple-use-ized the geometrical pattern, and the method which appears the latent image which has not been visually recognized if a certain means and operation were added to printed matter.

[0003] Although geometrical patterns, such as a design widely used for designs, such as security printed matter, a **** pattern, and a relief pattern, are used for the former typical example, it constitutes the pattern by set of the music streak by fixed streak width of face fundamentally as the forgery and the alteration preventive measure using the aforementioned geometrical pattern.

[0004] These patterns consider design nature, such as a design of printed matter, and in the extraction or the copying machine by photoengraving-process equipment, use the color which is hard to be reproduced, or make it a complicated music streak. There is a fault of having not brought about sufficient forgery and the alteration prevention effect with the advent of [although a role of a forged preventive measure is raised by generating moire to scanning I/O of a copying machine and a scanner] the photoengraving-process equipment which had advanced features recently, or a copying machine.

[0005] Moreover, the forgery and the alteration preventive measure which are used among the typical examples of the latter which adds a certain means and operation to the aforementioned printed matter, with a series of technology generally called a copy prevention streak, visually the latent image given into printed matter cannot recognize, a latent image appears by copying with a copying machine, and it is already indicated in the printed matter suitable for the forged prevention by such copying machine -- there is a technical means of ** of a degree - **

[0006] ** There is printed matter (JP,57-20395,A) which gave the latent image suitable for the forged prevention by the copy which displayed the character which consists of a topography element which is the half tone dot of 30% of 85 lines on the base paper front face.

[0007] ** There is printed matter (JP,60-79991,A) suitable for the copy prevention which finished the printed matter front face with sufficient appearance by printing a latent image by the half tone dot on the surface of a form, carrying out simultaneous printing of the background of a latent image and this concentration by 10,000 lines, and piling up, printing and making an ornament pattern the upper surface of a latent image including a background in the transparency ink of the thin color of the grade which is not reproduced by the copy.

[0008] ** When it interferes with 10,000 lines of a background, give heavy printing of the light color which is not reproduced by the form front face with a copying machine using the overprint version equipped with the wave pattern which consists of parallel lines which form a moire pattern, Since the moire pattern which dazzles a naked eye is formed, the front face of printed matter becomes difficult [existence of a latent image] to discriminate, and when it applies to a copying machine, a latent image and a wave pattern have the latent-image camouflaging method for copy prevention (JP,60-87380,A) only a background is reproduced without being reproduced.

[0009] However, since each method of the above-mentioned ****** had to be the screen pattern which consists of roughness and fineness of points, such as a half tone dot or 10,000 lines, and a line, it had the fault of not being suitable for using for the existing products, such as negotiable securities, such as a design, a bank note which is using the **** pattern abundantly, a stock certificate, and a debenture.

[0010] Invention-in-this-application persons consider as the method with which the fault which the method of the above-mentioned ****** has is suppliable enough, and have already introduced the technical means of ** of a degree, and **.

[0011] ** The streak more than the double lines of the portion which expressed the portion which gave single stroke lines and the latent image for the portion which does not give a latent image for the set pattern of a music streak by the streak more than double lines, and gave the latent image, The streak width of face of the sum total of the streak more than double lines is equal to the streak width of face of the streak of the single

stroke lines of a portion which d⬤ give a latent image. Branch from the s⬤ stroke lines of a portion which do not give a latent image, and and the boundary line on the streak of the portion which does not give a latent image, and the portion which gave the latent image further It applied for the creation method of the copy prevention pattern characterized by the straight line which crosses an abbreviation right angle, and the bird clapper, and its printed matter (Japanese Patent Application No. No. 206140 [six to]) to the straight line which touches a basic curve in the intersection of the basic curve which constitutes the set pattern of a music streak, and the border line of a latent image.

[0012] ** In a round term of the streak section on the sum total of the fixed-cycle rupture line of the portion which expressed the portion which gave the solid line and the latent image for the portion which does not give a latent image by the fixed-cycle rupture line to the set pattern of a music streak, and gave the latent image to it real-printed, and the non-streak section which severs and lacks the streak section The area of the non-streak section was added to the area of the streak section, and by the same length of the curve-like direction of the portion which gave the latent image, and the portion which does not give a latent image, the printed matter (Japanese Patent Application No. 7-138879) made into the rate of the same streak area was invented, and it applied.

[0013] The creation method of a copy prevention pattern and printed matter which gave forgery by the copying machine and the alteration prevention effect to the set pattern of music streaks, such as designs, such as negotiable securities, such as a bank note which needs copy prevention, a stock certificate, and a debenture, various certificates, and an important document, a **** pattern, and a relief pattern, with the printed matter which has the pattern of these ****s were able to be offered.

[0014] However, it is the present condition that it is becoming impossible for the copy preventive measure of the method of the above-mentioned **** to grow into sufficient forged preventive measure by advanced features of a color copying machine and the advancement of DTP (desktop publishing) technology by the end of today.

[0015] Then, in truth distinction, extensive and the machine reading inspection method which can carry out high-speed processing are widely adopted as solution of such a problem. Such technology in which the machine reading inspection method of today's printed matter detects the material by functional ink, such as a magnetic ink, infrared reflective absorption ink, and fluorescent ink, the fiber which forms print media, the quality of the material and chemicals, etc. originates in the specific electromagnetic wave which cannot be sensed to human being. There is much what is dependent on material fitness when producing printed matter, and it can give only the product with which economical efficiency balances in a production cost side.

[0016] Moreover, there is the optical reading method for the pattern on the printed matter which can apply printing material like the ink for general printing which can carry out visible as a method of not taking into consideration especially the production cost of printed matter. As the comparatively easy optical reading method, although OCR, OMR, a bar code, a 2-dimensional code, etc. are well-known, when using these optical reading methods for the existing product, change of a design and specification is required.

[0017] Moreover, it is also the method which has appeared on the market in the city widely, and since these optical reading methods can carry out visible [of the sign] as a printing streak, the danger of decode and an alteration is also expected and they are inadequate as forgery and the alteration prevention method.

[0018] Furthermore, there is a series of technology generally called electronic watermark as a method of giving the information for reading, without similarly changing design nature, such as a design, by the optical reading method. An electronic watermark is also called concealed DOIMEJI and digital watermark, and is technology which embeds copyright information at the document file in the high performance copy technology and high performance DTP technology, or its printed matter as main uses. As well-known typical technology in printed matter, it is the method called frequency use type.

[0019] An electronic watermark is said for there to be little degradation of the frequency characteristic also in a duplicate object, and, recently, is given to the digital image distributed on the Internet for the purpose of protection of copyrights in many cases. Moreover, since the effect is done so also in printed matter, it has also been used for the poster etc. more often.

[0020] It is a continuous tone (photograph gradation) pattern that an electronic watermark can demonstrate an effect most. A continuous tone (photograph gradation) pattern is one of the technology in which many methods, such as not only a frequency use type but a pixel substitution type, a pixel space use type, a

quantization error diffusion ty⬤tc., are proposed since it is multiple-va⬤mage data and sufficient redundancy exists, and many reference and patent application also attract attention today.

[0021] However, since the set pattern of music streaks, such as a design used for negotiable securities, a **** pattern, and a relief pattern, is a binary picture fundamentally and there is little redundancy, embedding of an electronic watermark is made difficult, since the signal for reading is weak as a result, it reads, and the low's has been [precision] a technical problem.

[0022] Therefore, development of the effective technology which can carry out truth distinction of a pattern that it has the forged prevention fitness which is the forgery and the alteration prevention method independent of the material fitness of printed matter, for example, is suitable for negotiable securities, such as a bank note, a stock certificate, and a debenture, various certificates, an important document, etc., by machine reading is desired.

EFFECT OF THE INVENTION

[Effect of the Invention] Although the line drawing for securities can be recognized with human being's visual sense with the truth distinction printed matter concerning this invention which consists of the above composition artistic effect ****** which a printing streak has by being able to embed invisible information to human being with constituting the line drawing for securities from a unit streak which consists of the unit which has two or more division lines, and this embedding information reading the line drawing for securities as a digital image, performing the Fourier transform moreover, and processing matching etc. since it is identifiable -- there are nothings and the forged prevention effect can heighten

[0098] By this invention, the thin streak of original drawing of printed matter is especially formed by the unit streak which consists of the unit which has two or more division lines. Two or more intervals which the part open circuit which adjoins mutually among two or more division lines in a unit makes Since it is simply identifiable in information, while it can embed information by making it set up corresponding to the information embedded, respectively, and being able to heighten the forged prevention effect by the Fourier transform pattern of the digital image of this printed matter moreover Handling is convenient at a low cost and it is very useful as a means which embeds invisibility information in various fields, such as a bank note, securities, various certificates, and an important document.

[0099] and artistic effect ****** which a printing streak has since it is impossible to recognize the information with human being's visual sense also in monochrome printing in the streak used for this invention -- there are also nothings

[0100] Furthermore, for the interval (pitch by which a minute open circuit is repeated) which enables formation of a thin streak in this invention at the visible division streak which consists of the invisibility plurality division line instead of a unit unit, and two or more division lines make, the information which does not include uniform composition but is embedded is the Fourier transform pattern of the digital image data of printed matter. By setting up so that it may be identifiable, it can have flexibility more and the printed matter in which high truth distinction of the forged prevention effect is possible can be realized.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] this invention was made in view of the above-mentioned point, and it aims at embedding information in the printed matter which has art, such as securities which consist of line drawings for securities, by giving a modulation to the line drawing for securities on the level which human being cannot recognize visually, without spoiling the artistic effect.

[0024] By the way, this invention●son etc. has already proposed invention●ut the printed matter and the distinction method of already constituting the thin streak of the line drawing for securities from the division streak section which consists of two or more division lines arranged in parallel by the longitudinal direction at the predetermined intervals in which truth distinction is possible, and the information embedding method as an application for patent No. 1519 [2002 to]. Invention concerning this application to precede is technology which decides the width of face and length of the division line to be human being's eyes so that the division streak section and the usual thin streak may look equivalent, carries out the Fourier transform of this, recognizes peculiar frequency in the Fourier transform pattern, and is applied to truth distinction etc.

[0025] However, in this invention to precede, two or more division lines of the division streak section which constitutes the thin streak of the line drawing for securities are only arranged in parallel in the longitudinal direction at the fixed interval, and the information which can be given is limited to the kind of peculiar invisibility frequency, and cannot give many variations. Then, let it be a technical problem to make it possible to embed information various finer again and to heighten the forged prevention effect in this invention, without devising the interval of arrangement of this division line, forming a thin streak, and spoiling the artistic effect.

MEANS

[Means for Solving the Problem] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible unit streaks by which two or more units have been arranged continuously. two or more above-mentioned units It consists of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes It is set up corresponding to the information embedded, respectively, and the information embedded the account of a top offers the printed matter which is characterized by the identifiable thing and in which truth distinction is possible with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained.

[0027] The composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes is the same about two or more above-mentioned units of all.

[0028] The digital image data in which an output of the printed matter which has the line drawing for securities which consists of two or more thin streaks is possible in order that this invention may solve the above-mentioned technical problem are created. It is the information embedding method of the printed matter which changes two or more above-mentioned thin streaks in the above-mentioned digital image data so that it may consist of visible unit streaks by which two or more units have been arranged continuously, and embeds predetermined information and in which truth distinction is possible. Two or more above-mentioned units are formed from the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Under the present circumstances, two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes It sets up corresponding to the information embedded, respectively, and the information embedding method of the printed matter which is characterized by making identifiable the information embedded the account of a top with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained and in which truth distinction is possible is offered.

[0029] It is characterized by similarly forming the composition concerning two or more intervals which the

part open circuit which adjoin●tually among two or more above-ment●d division lines in the above-mentioned unit makes about two or more above-mentioned units of all.

[0030] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible unit streaks by which two or more units have been arranged continuously. two or more above-mentioned units It consists of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of a thin streak. Two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes It is the truth distinction method of the printed matter which is set up corresponding to the information embedded, respectively and changes and in which truth distinction is possible. The Fourier transform of the digital image data of the above-mentioned printed matter is carried out, a Fourier transform pattern is created, and the truth distinction method of the printed matter which is characterized by discriminating the information embedded the account of a top by this Fourier transform pattern and in which truth distinction is possible is offered.

[0031] Composition concerning two or more intervals which the part open circuit which adjoins mutually among two or more above-mentioned division lines in the above-mentioned unit makes is characterized by being the same about two or more above-mentioned units of all.

[0032] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible division streaks which consist of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes It is set up, respectively and the information embedded the account of a top offers the printed matter which is characterized by the identifiable thing and in which truth distinction is possible with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained so that predetermined information may be embedded at the above-mentioned line drawing for securities.

[0033] The digital image data in which an output of the printed matter which has a line drawing for securities from two or more thin streaks, and in which truth distinction is possible is possible in order that this invention may solve the above-mentioned technical problem are created. It is prolonged in the direction which intersects the above-mentioned thin streak perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively. And it changes so that it may consist of visible division streaks which consist of the invisibility plurality division line arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which is the information embedding method of the printed matter which embeds predetermined information, and in which truth distinction is possible, and adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes so that predetermined information may be embedded at the above-mentioned line drawing for securities It sets up, respectively and the information embedding method of the printed matter which is characterized by making identifiable the information embedded the account of a top with the Fourier transform pattern with which the Fourier transform of the digital image data of the above-mentioned printed matter is carried out, and they are obtained and in which truth distinction is possible is offered.

[0034] In order that this invention may solve the above-mentioned technical problem, it is the printed matter which has the line drawing for securities which consists of two or more thin streaks and in which truth distinction is possible. the above-mentioned thin streak It consists of visible division streaks which consist of the invisibility plurality division line which was prolonged in the direction which intersects perpendicularly to the longitudinal direction of the above-mentioned thin streak, respectively, and was arranged in parallel along with the longitudinal direction of the above-mentioned thin streak. Two or more intervals which the part open circuit which adjoins mutually in the direction of a thin streak among two or more above-mentioned division lines makes As predetermined information is embedded at the above-mentioned line

drawing for securities, it is the tr⬤istinction method of the printed matter⬤hich truth distinction is possible which is set up, respectively and changes. The Fourier transform of the digital image data of the above-mentioned printed matter is carried out, a Fourier transform pattern is created, and the truth distinction method of the printed matter which is characterized by discriminating the information embedded the account of a top by this Fourier transform pattern and in which truth distinction is possible is offered.

[0035]

[Embodiments of the Invention] The form of operation of the printed matter concerning this invention, the distinction method, and how to embed the information on this printed matter is explained to a detail below with reference to a drawing based on an example. Two or more streaks containing the straight line (direct 10,000 lines) and curve of 10,000 lines gather, and the line drawing for securities currently used for securities, the bill, etc. consists of geometric designs. The streak used as the element which constitutes such a line drawing for securities is called "thin streak" by this invention. In the line drawing for securities, very high regularity exists in the interval of two or more thin streaks etc.

[0036] Paying attention to this regularity, this invention evaluates the interval of two or more thin streaks of the line drawing for securities, and correlation of a position, and utilizes them as a means of truth distinction.

[0037] Furthermore, with digital instruments, such as a scanner and a copying machine, although it is identifiable, two or more thin streaks which constitute the line drawing for securities which has this regularity from this invention Give a modulation and embed information so that a detailed portion (a part for " mentioned later open-circuit") with difficult recognition may be put in order and constituted from a visual sense for human being, and the printed matter obtained by doing in this way is changed into a digital image. a digital instrument (specifically computer) top -- the interval of the line drawing for securities and a position, and the above -- truth distinction is enabled by analyzing correlation by arrangement of a detailed portion etc. and discriminating the information embedded at printed matter

[0038] As composition which gives a modulation to the line drawing for securities on the level which cannot be recognized with human being's visual sense, this invention is making a part or all of a thin streak that constitutes the line drawing for securities the composition formed by the unit streak which consists of two or more units. Such a unit streak serves as two or more meeting unit streak group, and forms the line drawing for securities.

[0039] The length (henceforth "unit length") of two or more units is made into the predetermined length decided beforehand, and constitutes each unit from two or more invisibility fragmentation lines. Two or more of these fragmentation lines are prolonged in the direction which intersects perpendicularly with the center line of a thin streak, respectively, and are considered as the composition arranged by standing in a row in the direction of a thin streak, and are considered as the composition which embeds information by setting up suitably the mutual interval to the direction of a thin streak, and arranging two or more fragmentation lines in this unit (deciding the interval of the arrangement to the direction of a thin streak of two or more fragmentation lines.). That is, two or more intervals which the part open circuit which adjoins mutually among two or more fragmentation lines in a unit makes are set up corresponding to the information embedded, respectively.

[0040] In short, this invention forms the thin streak which constitutes the line drawing for securities which is original drawing by the unit streak. this unit streak with human being's visual sense, the thin streak and concentration of original drawing are equivalent, it considers as the composition whose line drawing for securities can be seen like original drawing, and the part open circuit which constitutes a unit serves as invisibility -- as -- the length (the length of the fragmentation line to the direction which intersects perpendicularly with the center line of a thin streak --) of a fragmentation line and width of face (the width of face of the fragmentation line to the direction where a thin streak is prolonged --) A further mutual interval is decided. And it is considering as composition where predetermined information is embedded by setting up the mutual interval of the fragmentation line in a unit suitably, and arranging it based on the regularity (the interval and direction of two or more thin streaks of the line drawing for securities.) of the line drawing for securities.

[0041] Thus, in order to discriminate the embedded information and to carry out truth distinction of printed matter, from this Fourier transform pattern, the Fourier transform is performed about the line drawing for securities which consists of unit streak groups which consist of two or more unit streaks, the information

about arrangement of the uni⬤th on the line drawing for securities an⬤ part open circuit in a unit is extracted, the embedded information is extracted and discernment is presented.

[0042] Furthermore, the thin streak from which this invention constitutes the line drawing for securities of printed matter does not make a unit a unit as mentioned above, constitutes it from a fragmentation streak which two or more fragmentation lines are arranged and changes, two or more fragmentation streaks gather, and it constitutes a fragmentation streak group, and also includes the printed matter which displays the line drawing for securities of printed matter, the distinction method, and how to embed the information on this printed matter by this fragmentation streak group.

[0043] (Example 1) The example 1 of the printed matter concerning this invention, the distinction method, and how to embed the information on this printed matter is explained. Drawing 1 is an example of the line drawing for securities used as original drawing of the printed matter concerning this invention. Although this line drawing 1 for securities has the **** element 3 which consists of the printed thin streak 2, it can recognize this thin streak 2 or the **** element 3 with human being's visual sense.

[0044] Based on the **** element 3 of this line drawing 1 for securities, the printed matter 4 of the example 1 of this invention shown in drawing 2 (a) is created. Printed matter 4 is a picture which two or more thin streaks 2 which constitute the **** element 3 are formed by the unit streak 6 which consists of the unit 5 of two or more same composition, respectively, and the **** element 3 is drawn by the unit streak 6, and changes. In short, the **** element 3 is expressed as the unit streak group 7 in which two or more unit streaks 6 gathered. This unit streak 6 of the interval and direction of streaks is completely the same as that of the thin streak 2 of original drawing.

[0045] the inside of the circle of drawing 2 (a) -- a part of unit streak 6 -- the enlarged view is shown One unit streak 6 in this enlarged view is expanded further, and drawing 2 (b) shows it. Each units 5A, 5B, and 5C which constitute the unit streak 6 are the same composition mutually, have the predetermined length (it is called "unit length".) decided beforehand, and consist of two or more fragmentation lines. Specifically, Units 5A, 5B, and 5C consist of two or more part open circuits 8 for information which embed information, respectively, and the start edge part open circuit 9 of both sides and the termination part open circuit 10 of the part open circuit 8 for information.

[0046] By the way, although the unit 5 of two or more same composition is repeatedly arranged continuously in this example 1 and the unit streak 6 is constituted, the units 5A and 5B which adjoin mutually are sharing the start edge part open circuit 9 and the termination part open circuit 10. If drawing 2 (b) is explained for this as an example, the termination part open circuit 10 of unit 5A is shared by both the units 5A and 5B as start edge part open circuit 9 of unit 5B, and the termination part open circuit 10 of division line 5B is shared by both the units 5B and 5C as start edge part open circuit 9 of unit 5C.

[0047] Although the unit 5 is considered as the composition which embeds predetermined information, drawing 3 is drawing showing the concrete composition of the unit 5 which embedded predetermined information. Between the start edge part open circuit 9 and the termination part open circuit 10, the part open circuits 81-84 for information of four are arranged, and this unit 5 is constituted. Predetermined information is embedded by deciding suitably the mutual interval of the part open circuits 81-84 for information of four.

[0048] Corresponding to the information element (example . signs, such as a number) which constitutes the information embedded beforehand, the interval is decided beforehand. By this example 1, an information element is made into a decimal digit and a corresponding example of an interval is shown in the next table 1. Although * and ** express an identifier among this table 1, respectively and being later mentioned about the need, identifier * corresponds to the interval of the start edge part open circuit 9 and the part open circuit 81 for information, and identifier ** corresponds to the interval of the termination part open circuit 10 and the part open circuit 84 for information.

[0049]
[Table 1]

情報／識別子	0	1	2	3	4	5	6	7	8	9	*	#
間隔（μm）	50	60	70	80	90	100	110	120	130	140	150	160

[0050] In order to embed the information which consists of the combination of the decimal digit "264" about a unit 5 based on this table 1 The interval of 150 micrometers, the part open circuit 81 for information, and

the part open circuit 82 for infor⬤on for the interval of identifier * and th⬤t open circuit 81 for information 70 micrometers, What is necessary is to arrange the interval of 110 micrometers, the part open circuit 83 for information, and the part open circuit 84 for information to 90 micrometers, and just to arrange the interval of the part open circuit 84 for information, and identifier ** for the interval of the part open circuit 82 for information, and the part open circuit 83 for information to 160 micrometers, respectively.

[0051] Unit length is set to 580 micrometers which is the value which totaled these intervals. Two or more units 5 of such composition are continuously repeated along with the thin streak 2 (refer to <u>drawing 1</u>) of original drawing, and the unit streak 6 is arranged and constituted.

[0052] Here, the need of arranging identifier * and identifier ** in a unit 5 is explained. Although the printed matter concerning this invention is mentioned later and it performs the discernment with meanses, such as pattern matching, as a Fourier resolution picture, since a picture will appear symmetrically if information "264" is checked by the Fourier resolution picture, it will show the same position and same intensity as what carried out the Fourier resolution picture of the information "462", and distinction of it becomes impossible.

[0053] Then, in order to enable this distinction, make identifier * correspond to the interval of 150 micrometers, identifier # is made to correspond to the interval of 160 micrometers, it registers with Table 1 with an information element, and the identifier to which * expresses an informational start, and # are used as an identifier showing an informational end, respectively. It turns out that it will be set to "*462" if "*264" can be replaced on a par with "264*" if "*462" is compared with "*264" and it reads from opposite direction still as mentioned above when using only identifier * showing an informational start here and not using identifier # showing an informational end namely, and "*264" and "*462" become the same Fourier transform pattern. Then, if identifier # showing an informational end is used, since "*264#" and "*462#" do not become the same pattern, they will become discriminable [both].

[0054] In the line drawing 1 for securities of original drawing shown in <u>drawing 1</u> , the width of face (size of a line) of the thin streak 2 is 55 micrometers. Although the fragmentation lines 8-10 of a unit 5 are invisible at human being's eyes, respectively when it is created as printed matter which formed the thin streak 2 by the unit streak 6, as shown in drawing 2 (a) The unit streak 6 needs to adjust the interval of the fragmentation lines 8-10, and the size (width of face W and length L) of a fragmentation line, in order to make it visible by human being's eyes like the thin streak 2 of the line drawing 1 for securities which is original drawing. Specifically according to the interval of the fragmentation lines 8-10, the size (width of face W and length L) is adjusted.

[0055] In this example 1, if the interval during the part open circuit corresponding to information "*264#" is equalized, it will be set to /(150micrometer+70micrometer+110micrometer+90micrometer+160micrometer)5=116micrometer. Corresponding to the numeric value of 116 micrometers, the interval of the average between this division line can set each width of face W of all the division lines of the part open circuit for information, a start edge part open circuit, and a termination part open circuit to 30 micrometers, and can set up length L with 293 micrometers. Even when the unit streak 6 is visible to human being by making the division line of a unit 5 into such a size, the division lines 8-10 will be in an invisible state.

[0056] By the way, although these people are not the technology which forms the thin streak 2 by unit streak 6 like this invention, in the negotiable securities which perform truth distinction by machine read, they constitute a part of thin streak from a division line, and have already performed patent application about the technology which invisibility-izes this division line more completely (refer to JP,2000-118121,A.). the part open circuit in this invention if this invisibility-ized technology is applied to this invention -- more -- completeness -- invisibility-ization is attained

[0057] The outline of the technology which invisibility-izes this fragmentation line is as follows. In case it decides in the length of a fragmentation line, the average of an interval with the part open circuit adjoined before and behind the fragmentation line is computed, and the width of face and length corresponding to this average are determined. The unit 5 shown in <u>drawing 3</u> explains concretely the composition which applied this technology to this invention.

[0058] For example, it is performed as follows when deciding the width of face and length of the part open circuit 81 for information. The interval between the start edge part open circuit 9 and the part open circuit 81 for information (interval corresponding to identifier *) is 150 micrometers, and the interval (interval

corresponding to an informati●ement "2") of the part open circuit 81 f●formation and the part open circuit 82 for information is 70 micrometers. The average of 110 micrometers of the interval of 150 micrometers of the both sides of this part open circuit 81 for information and 70 micrometers is computed, and suppose the width of face of the part open circuit 81 for information that the width of face and length in the case of becoming fixed at intervals of [of 110 micrometers] a fragmentation line are given.

[0059] As mentioned above, the thin streak 2 of the line drawing 1 for securities of original drawing shown in drawing 1 is formed by the unit streak 6. In order to display the line drawing for securities shown in drawing 2 (a) by the unit streak group 7 which is a set of the unit streak 6 Read the line drawing 1 for securities with digital instruments, such as a scanner, first, and it considers as digital image data, such as bit map data. this -- illustrating -- the thin streak 2 is processed with software (for example, general BAL chewiness stem as illustrator marketed from Adobe), and it transposes to the unit streak 6

[0060] or a computer -- illustrating -- you may create directly the digital image of the line drawing for securities shown in drawing 2 (a) displayed by the unit streak group 7 using software make it any -- if the printout of this digital image is carried out, the printed matter shown in drawing 2 (a) should just be created In this invention, since it does not consider as the summary of invention of the method of such illustrating of printed matter itself, explanation of this point is omitted.

[0061] Two or more unit streaks 6 which consist of two or more above units 5 gather, serve as the unit streak group 7, and display the line drawing for securities. These unit streak groups 7 have different spatial frequency based on the mutual interval of two or more unit streaks 7, moreover, information "*264#" is embedded to the unit 5, and if the printout of this is carried out, by appearance, the printed matter 4 concerning this invention which does not change in the line drawing 1 for securities shown in drawing 1 in which truth distinction is possible will be created.

[0062] Based on Table 1, in order to create the printed matter 11 which has the unit 12 which similarly embedded another information "*831#" at the same line drawing 1 for securities shown in drawing 1 , as shown in drawing 4 , each interval of the start edge part open circuit 9, information fragmentation 8 line, and the termination part open circuit 10 is decided, and a unit 12 is created so that it may correspond to information "*831#." The unit length of this unit 12 is 580 micrometers like printed matter 11.

[0063] And by the unit streak 13 which continues in the direction of plurality and a thin streak, and is repeatedly constituted in this unit 12, the thin streak 2 of original drawing 1 can be formed, and the printed matter 11 which displays the line drawing for securities by the unit streak group 14 for which the unit streak 13 as shown in drawing 5 gathered can be created.

[0064] Next, the means and method of discriminating the information concerned on the printed matter with which information was embedded by above how embedding information are explained. The above-mentioned printed matter 4 and 11 is read by readers, such as a scanner, and a reading result is held as bit map data (it is an example of the "digital image data" of this invention.). And the Fourier transform of this bit map data is carried out.

[0065] The Fourier resolution picture 15 of the printed matter 4 of this example is shown in drawing 6 , and the Fourier resolution picture 16 of printed matter 11 is shown in drawing 7 , respectively. The correlation based on enlargement explains how it appears in a Fourier transform pattern about each of the information "*264#" embedded for the example in these Fourier resolution pictures 15 and 16, and information "*831#."

[0066] In the Fourier resolution pictures 15 and 16 of printed matter 4 and 11, the peak position in a Fourier transform pattern is observed by the same frequency. That is, both unit length in printed matter 4 and printed matter 11 is 580 micrometers, and the peak is observed by the position of the frequency corresponding to this unit length, and the position of the integral multiple of this frequency. Discernment of the embedded information is not attached at this point.

[0067] However, the intensity of the peak in the Fourier transform pattern of printed matter 4 and printed matter 11 differed in both, and the difference among both has appeared notably especially in the 4th peak (a center to the 4th ring). In the unit 5 of printed matter 1, and the unit 12 of printed matter 4, although the intervals of arrangement of the part open circuit for information differ in order to embed information ("*264#", "*831#") different, respectively, it originates in this and the intensity of the 4th peak differs.

[0068] That is, if it is the same unit length, although a peak will be observed by the frequency position where a Fourier transform pattern is the same, if the intervals of arrangement of the part open circuit for information

in a unit differ, peak intensity di● Therefore, the interval of arrangement ● in the unit of the part open circuit for information concerning the information embedded to printed matter can be recognized based on this Fourier transform pattern. If it is made equivalent to the information which the interval of arrangement of this part open circuit for information embedded, embedding of the predetermined information on a printing streak and its reading will be realized.

[0069] By the way, although there are some concrete meanses to discriminate the embedding information on the printed matter concerning this invention from a Fourier transform pattern, they mention three meanses here.

(1) In reading image processing systems, such as a computer, make the Fourier transform pattern corresponding to predetermined embedding information memorize beforehand, and discriminate the Fourier transform pattern of the bit map data read in printed matter as compared with this Fourier transform pattern memorized beforehand (pattern matching).

[0070] (2) Prepare beforehand the concentration distribution curve (the concentration distribution curve which serves as the k-th peak from the inside among the peaks in a Fourier transform pattern is said.) of the k-th peak of the Fourier transform data corresponding to predetermined embedding information, and compare this with the concentration distribution of the Fourier transform data of the bit map data read in printed matter of the k-th peak.

[0071] (3) Calculate on-the-strength I (k) in the k-th peak position of the Fourier transform pattern of the bit map data read in printed matter by the following several 1.

[0072]

[Equation 1]

$$ I\ (k)\ = N\ \{ \sum_{i,j=1}^{n} \cos 2\pi k\ x_{ij} \}^2 $$

[0073] The numeric value which standardized the interval of the i-th fragmentation line in the unit 5 to which the number of the units 5 which N has in the whole streak, and n are given to by the number of the fragmentation line in a unit 5 here, and xij is given by the following several 2, and the j-th fragmentation line by unit length is expressed.

[0074]

[Equation 2]

$$ x_{ij} = (d_j - d_i)\ / \sum_{s=1}^{n} d_s \quad \cdots (2) $$

[0075] By these formulas (1) and (2), if the value of on-the-strength I (k) in the k-th peak position of a Fourier transform pattern is recognized, by solving simultaneous equations, it can become possible to ask for arrangement of the fragmentation line in a unit easily, and can embed by this, and information can be discriminated.

[0076] Discernment of the printed matter 1 which has as an example the unit 5 which embedded information "*264#" is explained. The digital image of this printed matter 1 is read, and the Fourier transform is performed, and suppose that the Fourier transform pattern was obtained. In a reader, the primary peak position of the FFT shows immediately that unit length is 580 micrometers.

[0077] And it is possible by reading the relative intensity of primary -- [secondary / 3rd] and the Fourier transform pattern in the n-th peak, respectively, applying this to more than one above 2, and solving simultaneous equations with the least square method to solve the list of arrangement of the division part open circuit in a unit 5, i.e., the interval of a fragmentation line.

[0078] When the interval which the start edge part open circuit 9, the part open circuits 81-4 for information, and the termination part open circuit 10 adjoin mutually can be found with 150 micrometers, 70 micrometers, 110 micrometers, 90 micrometers, and 160 micrometers and discriminates a decimal digit from these

simultaneous equations base⬤Table 1, it is discriminable that the emb⬤ed information is "*264#." In addition, it is identifiable similarly about the printed matter 2 which embedded information "*831."

[0079] As mentioned above, informational embedding and reading are possible by giving a variation to a fragmentation line, since the peak intensity of a clear Fourier transform pattern is obtained also in an example by which signs, such as the same number, are repeated in a unit, and arranging regularly. Although the information which consists of the decimal digit of 3 figures was embedded in this example 1, according to this invention, even the number of what figure can express signs, such as a number, using a fragmentation line, and can be recognized from the Fourier transform pattern which has the frequency and intensity of a characteristic peak position corresponding to information, such as a number, for the result.

[0080] (Modification of an example 1) Here, the printed matter concerning the modification of the example 1 of this invention is explained below. This modification forms the thin streak 2 which constitutes the line drawing 1 for securities of original drawing shown in <u>drawing 1</u> by the unit streak which consists of two or more units, and expresses the line drawing for securities of the **** element 3 as the unit streak group which is the meeting of a unit streak. The unit streak of the interval of streaks etc. of this printed matter is completely the same as that of the case of the thin streak of the line drawing 1 for securities of original drawing.

[0081] Two or more units are arranged continuously repeatedly, a unit streak is constituted, and two or more units have the same unit length mutually. A unit arranges in parallel two or more fragmentation lines prolonged in the direction which intersects perpendicularly with the center line of the thin streak 2 of original drawing in the direction of a thin streak, is constituted, and is taken as the composition which embeds information by this.

[0082] Although two or more fragmentation lines are arranged at the unit, and the length of this fragmentation line and width of face, and a further mutual interval are invisible in the fragmentation line itself, it is decided that the unit streak which consists of two or more units has equivalent thin streak 2 and concentration of original drawing, and the **** element 3 looks visually like the line drawing 1 for securities of original drawing.

[0083] By the way, although the interval (two or more intervals which the part open circuit which adjoins mutually among two or more fragmentation lines in a unit makes) of arrangement of two or more fragmentation lines of a unit is decided and predetermined information is embedded arrangement of two or more fragmentation lines within each unit in two or more units which constitute a unit streak from an example 1 -- each unit -- the same -- the unit with the arrangement of a fragmentation line same in short -- two or more repeats -- it is arranged continuously and the unit streak is constituted

[0084] However, the interval of arrangement of two or more fragmentation lines within each unit in two or more units which constitute a unit streak from this modification may not necessarily be the same about each unit. In short, two or more repeats per-continuum arrangement is carried out, and the unit whose arrangement of a fragmentation line is not necessarily the same constitutes the unit streak from this modification.

[0085] The printed matter concerning this modification is read with a scanner, and it opts for arrangement of a fragmentation line uniquely within two or more units, respectively so that the picture which carried out the Fourier transform of this as a digital image may serve as a predetermined Fourier transform pattern. In short, it is considering as the composition which embeds information by arranging a respectively original fragmentation line within two or more units so that a Fourier transform pattern may turn into a predetermined pattern.

[0086] thus, about two or more units of each which constitute a unit streak from printed matter of a modification It is what it opts for arrangement of two or more fragmentation lines uniquely, and two or more units by which arrangement of a respectively original fragmentation line was made are continuously arranged, a unit streak is constituted, and the line drawing for securities is displayed as by the unit streak group which is the meeting of a unit streak. The truth distinction is made in whether the Fourier resolution picture of printed matter matches the predetermined Fourier transform pattern.

[0087] By the way, a means to discriminate information from a Fourier transform pattern also about this modification is the same as an example 1, and is as follows. ** Match about the Fourier resolution picture of a predetermined Fourier transform pattern and predetermined printed matter memorized beforehand. ** Compare with the concentration distribution curve of the k-th peak of the Fourier transform data of printed

matter the concentration distribu●urve of the k-th peak of the predeterm●Fourier transform data prepared beforehand. ** Compute and discriminate arrangement of a unit from the intensity in the k-th peak position of the Fourier transform data of printed matter.

[0088] (Example 2) The above-mentioned example 1 constitutes two or more units from the unit streak which follows a longitudinal direction, and arranges and grows into it by making into a unit the unit which has a fragmentation line for a thin streak. However, it is good also as composition which does not make a unit a unit for a thin streak. From this viewpoint, this invention person etc. hit on an idea of the example 2 of this invention.

[0089] That is, the thin streak which constitutes the line drawing for securities of the printed matter concerning an example 2 does not make a unit a unit like an example 1, and consists of fragmentation streaks which two or more fragmentation lines are arranged and grow into the longitudinal direction of a thin streak. And a fragmentation streak gathers, a fragmentation streak group is constituted, and the line drawing for securities of printed matter is displayed by this fragmentation streak group.

[0090] Thus, two or more division lines used as the smallest unit of the component of the line drawing for securities are prolonged in the direction which intersects perpendicularly to the longitudinal direction of a thin streak, respectively, and are arranged in parallel along with the longitudinal direction of a thin streak. And although each length of a division line and width of face, and a further mutual interval are invisible in the division line itself, visually, a division streak has equivalent thin streak and concentration of original drawing, is the same as the line drawing 1 for securities of original drawing, and it is decided so that the **** element 3 can be seen.

[0091] Two or more intervals (mutual interval) which the part open circuit which adjoins mutually in the direction of a thin streak among two or more of these division lines makes are characterized by the composition set up, respectively so that predetermined information may be embedded at the line drawing for securities. This embedded information is identifiable by the Fourier transform pattern obtained by carrying out the Fourier transform of the digital image data which read the printed matter concerning this example 2 with the scanner, and were obtained. In short, two or more intervals which a division line makes are set up so that the information embedded may be identifiable by the Fourier transform pattern of the digital image data of printed matter.

[0092] The same thing is not contained for two or more intervals of all that the part open circuit mutually adjoined in the direction of a thin streak among two or more division lines for this example 2 embedding information, as for an important thing makes here. That is, the interval (pitch by which a minute open circuit is repeated) which two or more division lines make does not include uniform composition, but the information embedded is set up with the Fourier transform pattern of the digital image data of printed matter, so that it may be identifiable. If the number of division lines is large enough when the interval which two or more division lines make is chosen from for 50 to 150 micrometers at random using a random number and a division line is arranged here, even if it generates a division line what times, the same Fourier transform pattern will be obtained. On the other hand, if artificial artificiality is given to arrangement of a division line, the Fourier transform pattern differs from the aforementioned pattern. If a more concrete example is given, when setting up the kind of division line at intervals of 10 micrometers from 50 micrometers to 150 micrometers and arranging a division line using a random number from this inside, it sets up so that 80 micrometers may become the double precision of the selection probability of the division line of other intervals artificially. Thus, the Fourier transform pattern to the division line operated and arranged will produce a different Fourier transform pattern from the case where an interval is completely made into the division line chosen and arranged at random. The information embedded from this specific Fourier transform pattern can be extracted.

[0093] In short, the printed matter concerning an example 2 is considered as the composition which embeds information by completely arranging a division line uniquely within two or more units, respectively so that a Fourier transform pattern may turn into a predetermined pattern.

[0094] A means to discriminate the printed matter concerning this example 2 is the composition that truth distinction is performed by whether the predetermined Fourier transform pattern beforehand remembered to be the Fourier transform pattern obtained by carrying out the Fourier transform specifically matches and matches the digital image data which read the printed matter concerning an example 2 with the scanner, and

were obtained by the compar●

[0095] in addition, the thing for which the technology of performing invisibility-ization for the above-mentioned prior (referring to JP,2000-118121,A.) division line more completely is applied also in this example 2 in case the width of face of each division line, length, and a mutual interval are designed -- a division line -- more -- completeness -- invisibility-ization is attained

[0096] As mentioned above, although the form of operation of this invention was explained based on the example, it cannot be overemphasized by this invention that there are various examples within the limits of the technical matter which is not limited to such an example and indicated by the claim.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the **** element 3 which is the line drawing 1 for securities used as original drawing of the printed matter of this invention.

[Drawing 2] It is drawing explaining the figure of the picture section of the printed matter of an example 1.

[Drawing 3] It is drawing explaining the important section of the printed matter of an example 1.

[Drawing 4] It is drawing explaining the important section of another printed matter of an example 1.

[Drawing 5] It is drawing explaining the figure of the picture section of another printed matter of an example 1.

[Drawing 6] It is drawing showing the Fourier transform pattern of the printed matter of an example 1.

[Drawing 7] It is drawing showing the Fourier transform pattern of another printed matter of an example 1.

[Description of Notations]

1 Line Drawing for Securities
2 Thin Streak
3 **** Element
4 Printed Matter of Example 1
5, 5A, 5B, 5C Unit
6 13 Unit streak
7 14 Unit streak group
8 Part Open Circuit for Information
9 Start Edge Part Open Circuit
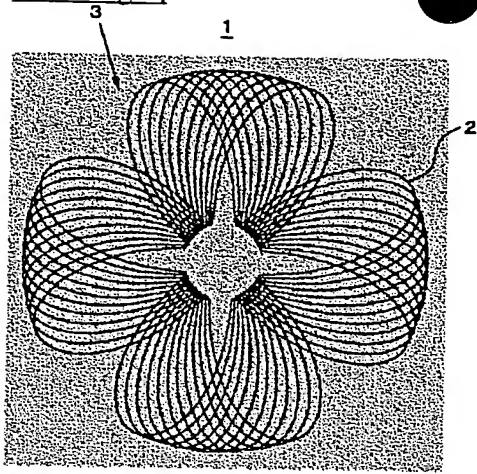10 Termination Part Open Circuit
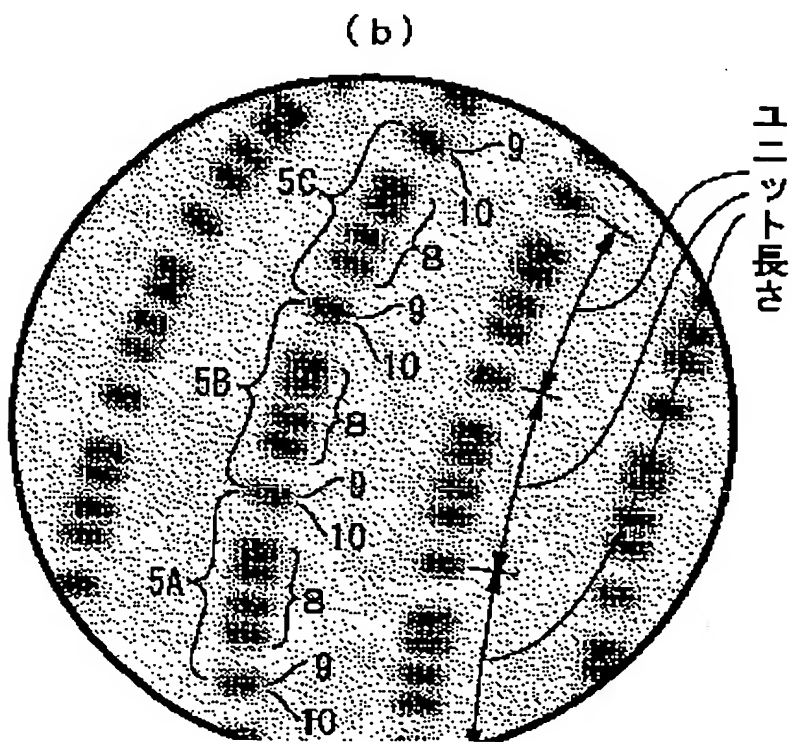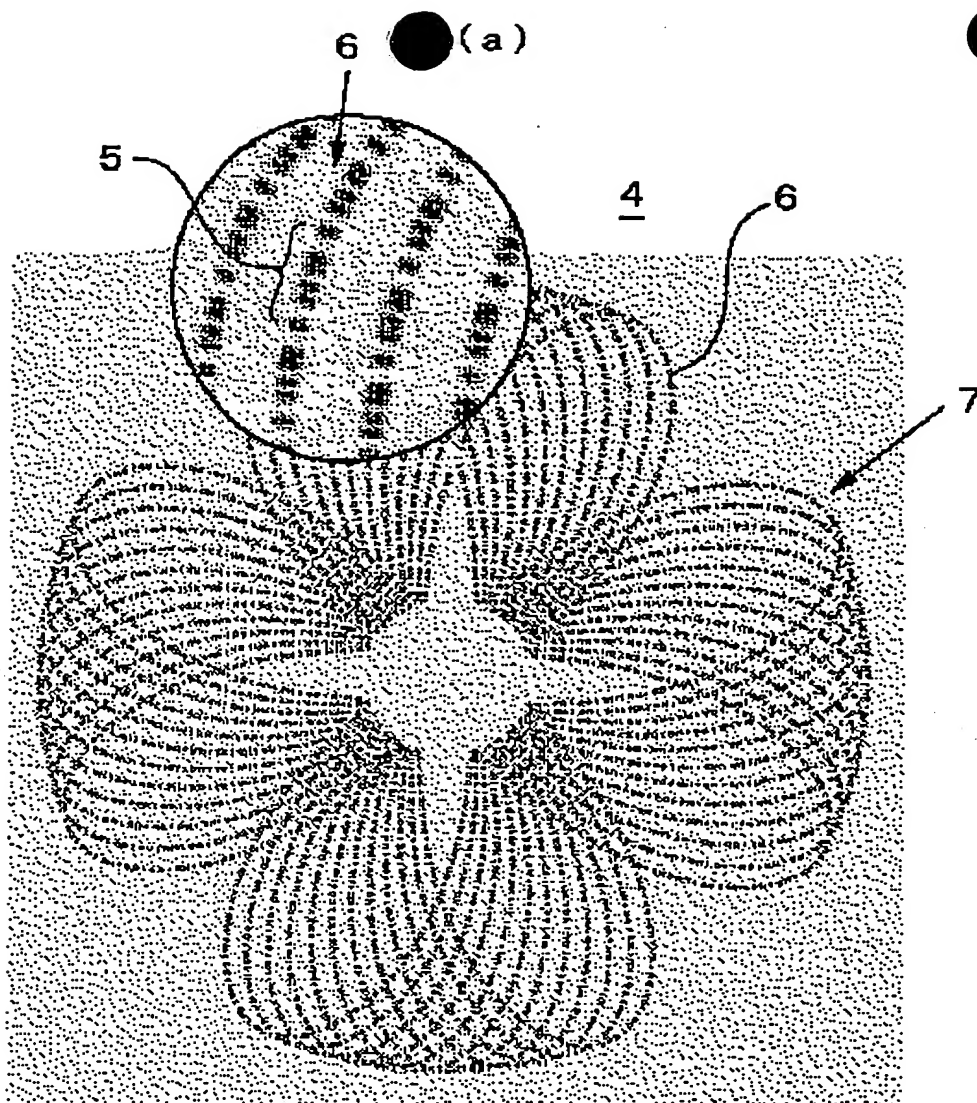11 Another Printed Matter of Example 1
12 Another Unit of Example 1
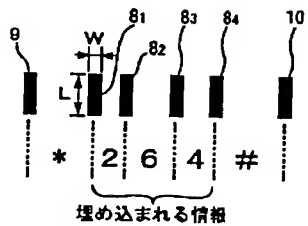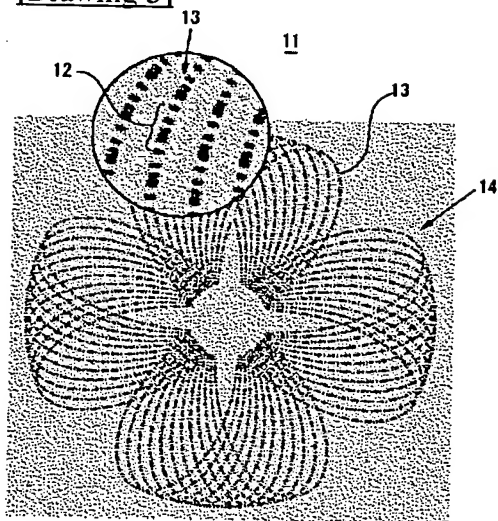15 16 Fourier resolution picture

DRAWINGS

[Drawing 1]

[Drawing 2]

(a)

6

5

4

6

7

(b)

5C

9

10

8

9

10

5B

8

9

10

5A

8

9

10

ユニット長さ

[Drawing 3]

<u>5</u>

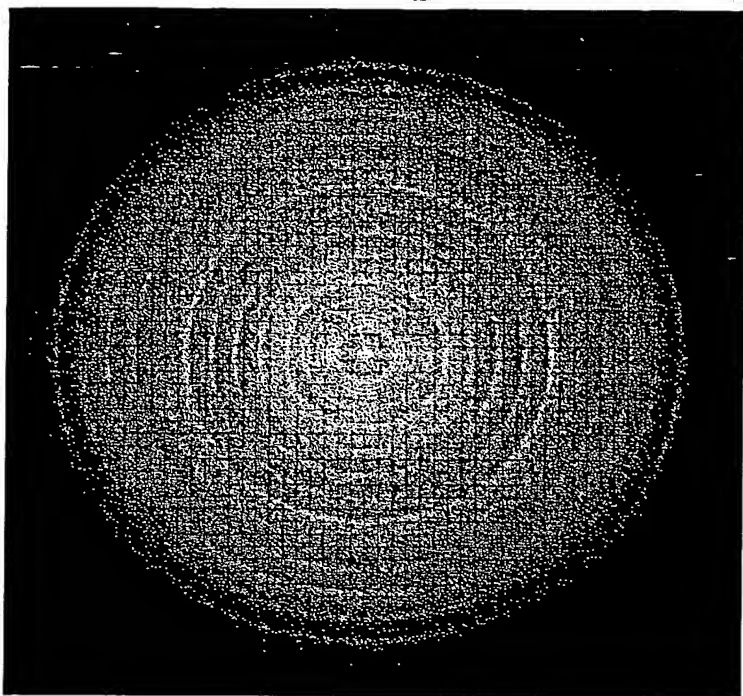## [Drawing 4]

<u>12</u>

[Drawing 5]

[Drawing 6]

15

[Drawing 7]

16